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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk *(Telephone* 332*).*

Forthcoming Events.

MAY 1-2.

Iron and Steel Institute:—Annual meeting at the Institution of Civil Engineers, London.

MAY 7.

Institute of Metals:—General meeting at the Institution of Mechanical Engineers, London. Annual May lecture by Major F. A. Freeth, O.B.E., F.R.S., D.Sc., on "The Influence of Technique on Research."

Institute of British Foundrymen.

APRIL 25.

London Branch (Junior Section):—Annual general meeting at 49, Wellington Street, London.

Paths to Peace.

Readers of THE FOUNDRY TRADE JOURNAL will recall the "Goodwill in Industry" Competition organised not long ago by the Glasgow and West of Scotland Association of Foremen Engineers and Draughtsmen, in which the winner of the first prize was well known in foundry circles. A report has now been issued by the Association concerned, entitled "Paths to Peace in Industry," and containing in summarised form the more valuable of the suggestions arising out of the competition and a good deal of other pertinent information collected from various sources. This report is to be commended for its brevity and clarity, and for its freedom from almost all notes and appendices. To a generation for whom the term "Report" conjures up the several hundred closely-packed and strenuous pages of a Blue Book it should be extremely welcome. As for the material presented, it is impossible not to be struck by the way in which it bears out a quotation from the prize Paper which serves in some measure as an introduction. "Virtually every useful suggestion has already been proposed at one time or another, and the question is now one of selection among previously-stated desiderata." It does not require an expert to discover, first of all the absence of any striking novelty among the suggestions and reflections, and secondly a general tendency to unanimity. The latter can be accounted for in part but not in whole by the nature of the organisation and hence of the committee responsible for the Report, who say frankly that they "must be regarded as expressing the views of Management as distinct from Capital and Labour." Highly suggestive is the list of percentage recommendations—not because the ninety-four individuals who made those recommendations necessarily have any special claim on our attention, but because they are more or less borne out by the findings of the Committee, so that they appear also to reflect the mature experience of a large number of people. It must be repeated that the bias of the report is towards management, emphasising its significance and its influence, but the term is perhaps used for convenience rather than for accuracy. Heading the list we find Shop Committees and Works Councils, recommended by 46 per cent. of the contributors. Profit-Sharing is a somewhat unexpected second with 25 per cent., and Suggestion Schemes are equally unexpected with 21 per cent.; 19 per cent. recommend Welfare, which, to judge by subsequent citations, is taken rather to mean extraneous activities than "works housekeeping," the aspect of welfare to which we have previously given our suffrage; 19 per cent. also speak in favour of "More personal touch between Master and Man," though no one seems very clear how this is to be brought about. Fifteen per cent. approve of Works Magazines, 12.5 per cent. of Co-Partnership in Industry, 12.5 per cent. also of Contributory Pension Schemes, while Payment for Holidays, Good Workshop Conditions, and Payment by Results all have a few supporters. It will be seen that while little or no direct dissatisfaction was expressed with the existing industrial system, every conceivable modification of it was put forward, and the Report contains summaries of a number of highly-interesting profit-sharing and co-partnership schemes that have proved successful over a number of years. It was perhaps these schemes and their varying character that prompted the comment: "Each case must be considered on its merits. There is no single golden key to unlock the doors of Goodwill in Industry." If the inquiry had done no more than reaffirm this inadequately-appreciated fact—and it has done a great deal more—its work would not have been in vain.

Welfare Supervision.

Some time in the future there will be introduced a Bill in the House for the compulsory employment by the larger foundries of a safety-first officer or welfare supervisor. The best weapon against such Governmental interference is by intelligent anticipation by as many individual units of the industry as possible, thus rendering legislation unnecessary. We believe if the duties of the proposed individual can be shown to be efficiently carried out, the plant will be better conducted, and economies will result. Primarily it appears essential to visualise the duties of the proposed officer and then for the management to allocate them to members of the staff to ensure that nothing is neglected. The duties can be summarised as follow:—(*a*) Buildings (comprising walls, foundations, floors, floor openings, windows); (*b*) roads and yards (including outside handling appliances, stacking and storage); (*c*) machinery and tools; (*d*) cranes, lifts and chains, and conveyors; (*e*) fire and explosion risks; (*f*) safety equipment and clothing, sanitation, heating, lighting and ventilating; (*g*) first-aid; (*h*) working methods (untidyness and carelessness in relation to accident prevention), and welfare in general. It is suggested that a chart be prepared detailing the departments coming within the survey and a decision taken as to the personnel to be held responsible for the control of each phase.

This is not so simple as may at first sight appear. For instance, the yards and roadways are generally under the charge of the mainten-

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ance engineer, and yet the foundry manager rightly assumes control of the stocking of his pig-iron supplies. A decision taken on this point would probably result in the issuing by the foundry manager of full instructions as to the essentials for the proper conduct and routine of this particular job, and once having done so could either forget about pig-iron storage or embrace it completely under his own control.

We cannot bring ourselves to the precept that one individual should be appointed specially to "think" safety for a firm. The management should see that every aspect of the subject has been studied and the whole of it, in portions, assigned to the various managers, engineers and foremen, the head of the maintenance department taking the lion's share. We fear that the appointment of a special officer would induce conditions analogous to interference and create with some individuals a type of mental chaos inimical of accident causation.

Chromium Plating.

DETAILS TO BE OBSERVED.

In the course of an article in a recent issue of "Chemical and Metallurgical Engineering" it is pointed out that for the successful deposition of chromium on a commercial scale, it is necessary to ensure correctness and uniformity in: (1) Temperature of the solution in contact with the work; (2) current density on the surface of the work; (3) condition of the surface to be plated; (4) composition of the solution. If these conditions are maintained, failure is rare. The temperature of the solution proper must be kept within two or three degrees of that desired. Often the temperature of the bath is not the same as the temperature of the film of solution in actual contact with the work. This is usually the case when the work is cold and of large section.

Current density is the total current per unit area of the work and the rack. Controlling the current density within practical limits normally will mean the manipulation of the proper rheostats until the desired amount of current is passing. If the contacts are poor, however, the current passing through the work will not necessarily be the same as the current indicated on the ammeter. The current density in one part of the work is likely to be higher than calculated, while in another it may be lower.

The surface to be plated must be clean, free from grease and from oxide, and must not be passive. Passivity can be induced either by anodic cleaning or by prolonged buffing. This condition will hinder normal deposition. The quality of the undercoating can also be included as one of the conditions of surface which must be correct. If the underlying copper or nickel layers have been improperly applied, even though they may apparently be satisfactory after buffing, chromium plating will tend to strip them off. Steel and nickel require a little more careful regulation of current density than copper at temperatures in excess of about 90 deg. Fah., while at lower temperatures it becomes difficult to deposit bright chromium upon these metals, at least on a commercial scale.

The fourth requirement, uniformity of composition of the solution, has received much more attention comparatively than it merits. If a good formula is adopted, precautions against contaminations are taken, and the solution is corrected periodically on the basis of the results of a chemical analysis or similar procedure, this matter should give the least amount of difficulty.

Means for ensuring the first two of these four essentials of successful plating—uniform temperature and current density—are mechanical in nature and are to a large extent taken care of in the design and construction of the apparatus.

Progress in Coke Research.

ANNUAL REPORT OF THE NORTHERN COKE RESEARCH COMMITTEE.

A recent report* issued by the Northern Coke Research Committee outlines some of the more important results which have been obtained in the Coke Research Laboratory at Armstrong College, Newcastle-upon-Tyne, and at various works during the year ending December 31, 1929. The report states that cokes obtained from "box tests" agree well with those made in full-scale oven charges, but "bag tests," while giving good results on the whole, are less reliable. Coke from "box tests" tends to be larger in size than the corresponding full-scale oven cokes. Uncompressed cokes have been shown to be more porous, larger and of higher shatter index than compressed cokes. Examination of gas cokes made from the same coal, in vertical and horizontal retorts indicated that "horizontal" cokes were larger, denser and of higher shatter index than "vertical" cokes.

Examination of the influence of the size of coal on the resulting coke has shown that up to a certain degree of fineness, the shatter index of a coke increases with decreasing size of coal particle, and it is concluded that to obtain a strong coke the proportion of coal above ¼ in. in size should be a minimum, whilst the influence of the coal below $\frac{1}{32}$ in. is to some extent adversely affected by its liability to oxidise. Cokes produced from the same good Durham coking coal in "patent" ovens, in compressed and uncompressed charges, and in beehive ovens were submitted to full-scale cupola tests, and it was shown that the uncompressed "patent" coke had the lowest melting efficiency, whilst the beehive coke was but slightly superior to the compressed "patent" coke.

Combustibility Tests.

A large number of cokes were examined by the special combustibility test developed in the Northern Committee's laboratory. Cumberland cokes have been shown to give lower maximum temperatures and greater carbon consumptions than Durham cokes. An examination of the influence of catalysts on combustibility indicated that impregnation of a coke with ferric oxide caused a marked lowering of the maximum temperature and an increase in carbon consumption; conversely, with a coke containing a ferruginous ash, extraction of iron with hydrochloric acid diminished the carbon consumption. It was not possible, however, to correlate the behaviour of cokes on combustion with their ash analyses. A number of cokes have been prepared in an experimental oven which takes a charge of 3 cwts. of coal. Except in porosity, cokes made in this way are closely similar to the corresponding full-scale cokes, and it is concluded that this method has substantial advantages over "box tests."

Blending Experiments.

Utilising the experimental oven, blending experiments have been carried out with Northumberland high-volatile "non-coking" and typical Durham coking coals. Chemical examination showed that the Northumberland coals, compared with Durham coking coals, were characterised by high moisture and volatile contents, by low caking indices and by low-carbon and high-oxygen and sulphur figures; laboratory tests at 600 deg. C., by the Gray-King assay, indicated that Northumberland coals produced smaller quantities of coke and gas, but greater quantities of tar and liquor than Durham coals. It was found that, on carbonisation, Northumberland coals gave cokes of lower shatter index than Durham coals; blending experiments showed that the mechanical strength of Durham cokes was considerably diminished by additions of 10 to 20 per cent. of Northumberland coals; but that greater proportions of the latter did not give a proportionate lowering of the mechanical strength. Caking indices determined by the Gray-Campredon method are found to give but little indication of the shatter index to be anticipated in a coke.

Standard Specification for Shatter Test.

The Northern Coke Research Committee has collaborated with the Midland and Scottish Committees in preparing a standard specification for the shatter test (see elsewhere in this issue), and valuable results will undoubtedly be obtained as a result. The Committee is also represented on the British Engineering Standards Association Panel for the standardisation of an agglutinating test for coal and, at the request of this Panel, is carrying out a certain amount of work on this test.

The report concludes by stating that, although since its formation the Committee has given much information as to variations in the quality of coke which may result from variations in carbonising conditions, the general trend of the research is to show that a knowledge of the intrinsic carbonising properties of the coal is of primary importance. The blending experiments have shown that the addition of quite small quantities of inferior coking coal produce a more than proportionate lowering in the quality of the coke, and, as the majority of coke ovens and gasworks are carbonising coals which are in themselves almost invariably blends, and as coals are blended for export purposes, a knowledge of the fundamental principles involved in the practice of blending is of the utmost importance to the whole industry. For these reasons the blending programme is being actively pursued.

* Annual Report No. 1. Summary of the work carried out in the Northern Coke Research Laboratories during the year ending December 31, 1929. Published by the Northern Coke Research Committee, Armstrong College, Newcastle-upon-Tyne.

Sheffield Section of the Institute of British Foundrymen.

The annual business meeting of the Sheffield Section of the Institute of British Foundrymen was held at Sheffield on April 11.

The Hon. John W. North, of the Staveley Coal & Iron Company, was elected President on the proposition of Mr. G. L. Oxley (retiring President), seconded by Mr. J. T. Goodwin. Mr. G. C. Castle was elected senior vice-president and Mr. C. D. Pollard, junior vice-president.

Mr. T. R. Walker was re-elected hon. secretary and treasurer. Messrs. H. Bradley, J. Roxburgh and W. A. Macdonald were elected to the Council, and Messrs. G. C. Castle, J. R. Hyde and G. L. Oxley were elected representatives to the General Council. Messrs. T. Singleton and A. Whiteley were elected auditors.

Flodin Direct-Steel Process.—As already reported, the Fagersta Works in Sweden in 1928 installed a Flodin furnace for the manufacture of steel directly from iron ore. The chief engineer of the works reports that the large-scale experiment has turned out well. The plant functions without any trouble, and the process has proved serviceable in actual working. The quality of the steel obtained is also good. Twenty men are now employed on this furnace, but with large units and more suitable arrangements the output can be increased without increasing the number of attendants, making the labour cost no higher than in the case of Bessemer and open-hearth steel-making. The consumption of charcoal is about one-half of that of the blast furnace, and the consumption of electric current no higher than in the case of the manufacture of electric pig-iron.

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American Foundrymen's Association.

CLEVELAND CONVENTION PAPERS.

Some fifty subjects appertaining to foundry practice are scheduled to be submitted to the forthcoming convention of the American Foundrymen's Association. Whilst Great Britain, Canada and Australia are to present Papers, it is noteworthy that of other countries only Germany is represented. France and Belgium being absent for the first time since the system of Exchange Papers was inaugurated.

The shop-operation courses detailed are designed for the instruction of the practical shop man.

Schedule of Sessions and Papers.

MONDAY, MAY 12.

2.00 p.m.—Opening Business Session.

4.00 p.m.—**Shop Operation Course.** *Grey Iron.* "Cupola Materials," introduced by Mr. C. J. Scullin and Mr. E. J. Lowry.

TUESDAY, MAY 13.

10.00 a.m.—*Foundry Costs.* "A Recommended Standard Cost System for Grey-iron Foundries," by Mr. J. L. Carter, Messrs. Sacks-Barlow Foundries, Inc., Newark, N.J., and "Organising a Non-ferrous Foundry Cost Group," by Mr. C. S. Humphries, The Westco Chippewa Pump Company, Davenport, Iowa.

10.00 a.m.—*Malleable Founding.* "Continuous Melting Process as Applied to Malleable Iron," by Mr. B. R. Mayne, Saginaw Malleable Iron Div., The General Motors Corporation, Saginaw, Mich.; "Factors Affecting Machinability of Malleable Cast Iron," by Mr. H. A. Schwartz, National Malleable & Steel Castings Company, Cleveland; and "Some Features of the Pulverised-Coal-Fired Air Furnace," by Mr. E. F. Wilson, Jefferson Union Company, Lockport, N.Y.

12.15 p.m.—Discussion on *Malleable Iron Founding.* Chairman, Mr. P. C. DeBruyne, Moline Malleable Iron Company, St. Charles, Ill.

2.00 p.m.—*Cast-Iron Metallurgy.* "Effects on Cast Iron of Prolonged Heating at 325 to 545 deg. C.," by Mr. R. S. MacPherran and Mr. R. H. Krueger, Allis-Chalmers Manufacturing Company, Milwaukee; and "Blistering Tendency of Some Cast Iron when Enamelled," by Mr. A. I. Krynitsky and Mr. W. H. Harrison, Bureau of Standards, Washington.

2.00 p.m.—*Non-ferrous Foundry Practice.* "Deep-Etch Test of Brass," by Mr. W. F. Graham and Mr. L. A. Meisse, Ohio Brass Company, Mansfield, Ohio; "Application of Ingot Metal to Production of Brass and Bronze," by Mr. Wm. Romanoff and Mr. C. O. Thieme, Messrs. H. Kramer & Company, Chicago; and "Overcoming Alloy-Ingot Troubles in the Brass Foundry," by Mr. Wm. S. Paulson, Messrs. Thos. Paulson & Son, Inc., Brooklyn, N.Y.

4.00 p.m.—**Shop Operation Courses.** *Grey-Iron Founding.* "Cupola Operation," by Mr. R. S. MacPherran and Mr. F. J. Walls. *Steel Founding.* "Chipping, Grinding and Riser Removal," by Mr. E. R. Robinson. *Non-ferrous Founding.* "Fuel-fired Furnace Melting," by Mr. E. R. Darby.

WEDNESDAY, MAY 14.

10.00 a.m.—*Management.* "Personnel Management," by Dr. Harry Meyer, Frigidaire Corporation, Dayton, Ohio.

10.00 a.m.—*Grey-Iron Foundry Practice.* "Briquetting Cast-Iron Borings," by Mr. H. Rayner, Messrs. Dodge Bros. Corporation Division. Chrysler Corporation, Detroit; "Continuous Melting from Cold Stock of Grey Iron in Electric Furnace," by Mr. N. L. Turner, Beach Foundry, Limited, Ottawa, Canada; and "Methods for Determining the Volume Changes Undergone by Metals during Casting," by Mr. E. J. Ash, A.F.A., Research Associate, U.S. Bureau of Standards, Washington.

10.00 a.m.—*Non-ferrous Founding.* "Care and Maintenance of Fuel-fired Furnace Linings in the Non-ferrous Foundry," and "Selection and Use of Refractory-Maintenance Cement in the Non-ferrous Foundry," by Mr. H. E. White, The Lava Crucible Company, Pittsburgh; "Stronger Aluminium Castings by Improved Foundry Practice," by Mr. E. M. Gingerich and Mr. H. J. Rowe, Aluminium Company of America, Pittsburgh; and "Progress in Die-Casting Industry," by Mr. Marc Stern, The A. C. Spark Plug Company, Flint, Mich.

2.00 p.m.—*Sand Control.* "Sand Control as Viewed from the Producers' Standpoint," by Mr. W. W. Kerlin, The Enterprise Sand Company, Pittsburgh.

2.00 p.m.—*Management.* "The Value of Sales Analysis and Market Research," by Mr. J. P. Newman, The McGraw-Hill Publishing Company, New York; and "The Value of Cleanliness and Neatness in a Foundry," by Mr. Ed. Trapken, Sandusky, Ohio.

4.00 p.m.—**Shop Operating Courses.** *Steel Founding.* "Core Room Practice," by Mr. J. M. Sampson and Mr. H. E. Mooney. *Grey Iron Founding.* "Gating and Risering," by Mr. H. W. Diertert, Mr. E. M. Handley and Dr. Fritz Meyer. *Non-ferrous Founding.* "Induction-Type Electric-Furnace Melting," by Mr. R. W. Parsons.

THURSDAY, MAY 15.

10.00 a.m.—*Steel Founding.* "Reclaiming Steel Foundry Sands," by Mr. M. D. Pugh, Illinois Testing Laboratories, Inc., Chicago; Address by Mr. Geo. Batty, Steel Castings Development Bureau, Philadelphia; and "Australian Steel Foundry Practice," by Mr. D. Clark, Adelaide, Australia. (Submitted on behalf of the Bureau of Steel Manufacturers of Australia.)

10.00 a.m.—*Apprentice Training.* "Foundry Apprentice to Apprentice Foreman," by Mr. E. H. Ballard, General Electric Company, West Lynn, Mass.; and "Where are the Young Foundrymen?" by Mr. S. W. Utley, Detroit Steel Casting Company, Detroit.

12.15 p.m.—Discussion on *Steel Founding.* Chairman, Mr. W. J. Corbett, The Fort Pitt Steel Casting Company, McKeesport, Pa.

12.15 p.m.—Discussion on *Non-ferrous Founding.* Chairman, Mr. H. M. St. John, The Detroit Lubricator Company, Detroit.

2.00 p.m.—*Grey-Iron Metallurgy.* "Carbon and Sulphur in the Cupola—Some Properties of Coke," by Mr. Jas. T. MacKenzie, American Cast Iron Pipe Company, Birmingham, Ala.; and "Correlation of Tests for Cast Iron," by Mr. J. G. Pearce, director, British Cast Iron Research Association. (Presented as the Annual Exchange Paper of the Institute of British Foundrymen.)

4.00 p.m.—**Shop Operation Courses.** *Steel Founding.* "Practical Aspects of Heat-Treating," by Mr. A. W. Lorenz; "Manganese Steel," by Mr. H. P. Evans; "Alloy Steel," by Mr. D. Zenge; and "Fuel Oil," by Mr. A. C. Jones. *Grey-Iron Founding.* "High-Test Irons," by Mr. H. Bornstein and Mr. F. B. Cogle. *Non-ferrous Founding.* "Indirect Arc-type Electric-Melting Furnaces," by Mr. D. E. Braggi.

FRIDAY, MAY 16.

10.00 a.m.—*Materials Handling.* "Continuous Core Ovens," by Mr. D. B. Hill, Messrs. Palmer-Bee Company, Detroit; "Materials Handling," by Mr. W. M. Booth, Syracuse, N.Y.; and "Reducing Materials-Handling Costs in the Jobbing Foundry," by Mr. F. C. Campbell, The Eastern Corporation, N.Y.

10.00 a.m.—*Melting Furnaces and Core Practice.* "Induction Furnaces for Ferrous and Non-ferrous Metals," by Mr. Manuel Tama, Berlin, Germany; "Value of Analyses and Specifications for Core Oil," by Mr. J. A. Gitzen, Lindsay-McMillan Company, Milwaukee; and "A Study of Non-ferrous Crucible Melting," by Mr. H. E. White, The Lava Crucible Company of Pittsburgh.

Random Shots.

We shall, I suppose, be hearing very soon that the vanguard of the annual American invasion is crossing the Atlantic. We hear less of a corresponding English invasion of America, doubtless because there isn't one, on anything like the same scale. Mr. Snowden sees to that! I heard the other day, however, that Mr. J. T. Goodwin, M.B.E., the well-known I.B.F. past-President, is going to the States in May, and now I learn that Mr. J. G. Pearce, of the Cast Iron Research Association, sailed last Saturday on the "Lancastria" on a business visit to the United States and Canada. Mr. Pearce is giving this year's I.B.F. Exchange Paper to the American Foundrymen's Association Convention, which is being held at Cleveland in May. The "Lancastria," if I mistake not, is a boat of good omen for foundrymen. . . .

* * *

A delightful story has come my way as a result of my reference to the Ideal Homes Exhibition. It was told to me by the victim (if victim be the word!), so I can vouch for its authenticity. He had occasion to go round the stands of the grate and stove manufacturers, on business quite unconnected with his foundry interests, and out of pure curiosity he inquired of one very talkative young man what kind of foundry the firm had. He tells me that he hasn't quite decided whether he looked like a greenhorn, or whether the other fellow *was* one, but when he asked how many cupolas the firm had he was told: "We've fifty of 'em—and all running about on wheels!" My correspondent adds that it must have been some foundry!

* * *

And so we shall have no more Dewarisms, and the passing of Lord Dewar will be mourned by many whose acquaintance with his whiskey is of the slightest. Hard-working purveyors of alleged humour—"Marksman," for example, learnt long since to look eagerly for the pearls of wit he was wont to cast before his fellow-guests at City banquets and ceremonial dinners. Now they will be reduced to searching the files and conning the anthologies, and in so far as live wit is always to be preferred to dead wit, their readers too will be the poorer. I cannot do better than mark the occasion, as many of my most distinguished contemporaries have done, by giving you a few examples of the late Lord Dewar's genius.

* * *

DEWARISMS.

Judge no man by his clothes, but by his wife's clothes.

The man who wakes up to find himself famous hasn't been asleep.

London is a city of the quick and the dead.

Many a bachelorship has been wrecked on a permanent wave.

Marriage is a committee of two with power to add to their number.

Motor-cars are increasing by leaps and bounds; pedestrians are surviving by the same process.

Only women and Governments are allowed to change their minds.

Minds are like parachutes: they function only when they are open.

MARKSMAN.

Modern Core-Making Practice.*

By C. Wood.

Cores are used to provide holes, recesses and openings in the finished castings, and are, therefore, inserted in the moulds in order to produce these. The essentials of the cores are to block out these cavities in the mould, and they should consist of a body of sand that will resist the action and pressure of metal, and also permit the free passage of gases. The gases created in the mould must pass out of the mould through these cores and not through the metal.

Core-making includes the ramming of sand into the core boxes, and the effective drying of the cores made. In its simplest form the actual making of cores is done in two-part boxes made of either wood or iron to permit of the core being removed. Core wires or core irons are used in the making of large cores, these being inserted in the core box during ramming. These are usually made roughly to the shape of the core and are used to give strength and solidity to the core. Wax core vent is used to permit the free passage of air in certain cores. This consists of a waxed string or wick laid in the centre of these cores, which, on drying, is either burnt or melted out, thus leaving a free passage for the gases to escape.

In larger types of cores, small pieces of coke are placed to allow of the porosity of the core. Many moulds are made up almost entirely of cores, each of which is made up in a separate core box. A core as used in moulding may be described as a mass of sand moulded to the shape, and subsequently baked hard necessary for insertion in a sand mould, in order to produce a desired internal shape to the casting produced by the metal poured into the mould.

Among the many important points to be considered in the production of good cores are:—(1) The class and density of sand used; (2) the bond of the sand; (3) the weight and size of core; (4) the thickness and general contour of the casting for which it is to be used; and (5) the drying temperature of the core.

Many very highly technical details in this work are treated as common unimportant details, because of the superficial view which is often taken of foundry work in general by engineers and those to whom the intricacies of foundry work are an unknown quantity.

Core-Making Machinery.

Core machines have long been known for the production of straight, round, square or octagonal cores, these usually being of the type known as the "sausage machine." In these, the sand (usually sea sand bonded with oil or oil compound) is fed into the hopper of the machine and conveyed by means of a screw to the die of the machine, whence it is ejected in a comparatively compact core having the form and shape of the die through which it passes.

This type of machine is well known and is largely used for simple cores of comparatively short length. Pneumatic machines, such as are used for making moulds, are also used for more or less intricate cores where a large production is necessary, and in this case, as in the case of core-making by hand, core boxes are necessary.

A new type of machine now on the market is that known as the Perfect Core Machine, by means of which all types of cores can be made. This machine has been designed to meet the demands of the foundry trade for improved equipment. It will permit the use of interchangeable core boxes constructed of wood or iron, and is adaptable for the making of irregular-shaped cores, in addition to straight cores of any cross-section. It is suitable for the making of round, half-round, chamber, square and similar shaped cores, any mixture of sand can be used, and vents, strengthening rods and chills can be fixed in all cores exactly as desired. The practice for the core shop to be supplied with a separate core box for each round core required, or with several lengths of stock core box of each diameter, is eliminated; only one bush is required for all lengths of core up to the full length of each bush. The base of each bush is formed by an internal plate, and, being adjustable, only the exact length of core required is rammed up; the core is then ejected from the bush by the operation of a hand-wheel.

Although all cores are rammed by hand, a considerable economy, combined with increased efficiency, is effected in the making of each core, compared with the practice of rapping and separating the box to remove the core.

For cores of irregular shapes, the frame that receives the bushes for the round and similar cores is removed from the table of the machine, and the special box can be fixed by means of two bolts. Specially-shaped pieces can be fixed to the frame, or loose, according to their position or design, the box is then rammed up and the core ejected without any rapping or separating of the box to remove the core.

Application of Pneumatic Machines to Core-Making.

Machines, similar in design and construction to moulding machines, are employed for certain classes of cores, the core boxes being substituted for pattern plates and moulding boxes. These boxes are laid on the table of the machine, the sand being rammed by hand, mechanical pressure or by jolting. Methods are also adopted to separate the rammed core from the core box. By means of a roll-over machine, on which the cores are rammed into the core boxes by hand or other suitable means, a metal plate is fastened on the tops of the core boxes, being clamped tightly to enable the cores to be transferred to the plate ready for placing in the stove. This is done by rolling the table over so that the cores are resting on the plate; the clamps being removed from the core box, the cores can be withdrawn downwards from the core box and remain on the core plate ready for the core oven.

Medium- and large-sized cores can be made on the plain jolt machine or, indeed, on any type of jolt machine. Core boxes have a much longer life when used in this manner, and do not receive the drastic handling usually met with when hand rammed. When jolting, it must be remembered that the core irons will be displaced in a downward direction owing to the jolting of the machines. This necessitates the placing of the irons higher up further from the face of the core box, allowance being made for the fall of the core. This can be fairly accurately determined by practice within a very small margin.

Sands for Core-Making.

Considering the conditions obtained from the time the core leaves the core box until the mould is cast and the subsequent dressing and cleansing of the casting, it will be understood what are the properties demanded of the sands used. Cores may have to be handled in either green and dried state, and the sands used must therefore possess cohesion and strength in both states. The sand must be open and somewhat porous to allow of the ready exit of gases created during casting operations. It is also necessary that the core should withstand great heat and also the stresses due to the pressure of the fluid metal, so that the sands must be strong when dried, with the grains well cemented together, but which is at the same time neither friable nor liable to crack.

After casting, the core should leave the casting readily and it should break up easily—a feature directly opposite to that required when in the mould. After removal of the core from the casting, the latter should present a clean smooth surface. Such conditions can only be satisfactorily met by the careful selection of sands and binding mediums and thoroughly efficient mixings.

The sand must, of course, have a very high refractory value, and, consequently, a high silica content, but it must also have bond and cohesive properties when dried, and also in the green state before drying. Another condition upon which the free venting of the cores depends is the choice of sands which have, as far as possible, uniform grain size. Sand reclaimed from the fettling and dressing shops is often mixed with new sand, after cleaning and sieving, to ensure the absence of metal and foreign matter.

Generally speaking, there are two classes of core sands:—(*a*) naturally bonded sands and (*b*) sands without bond—used for oil-sand cores. The base of these naturally bonded sands is ordinary red or yellow sand, such as is used for moulding purposes, and in some cases with a proportion of reclaimed sand from the fettling shop mixed with a binder and some material to give porosity when the sand is dried. These binding materials include core gums, resins, dextrines, molasses, with naturally bonded sands, it is not at all satisfactory to use oil as a binder.

In the case of cores used for steel castings, a common binding medium is clay wash and molasses or clay wash and flour. Sands for cores in steel castings must, of course, have a high silica content, and, consequently, the binders chosen must be such that fusion or collapse of the core will not take place at the temperature of molten steel. There are several characteristics peculiar to each binding material which have been revealed during the carrying out of numerous experiments with various mixtures of sands and binders.

Cores made from binders containing starch or starch compounds are generally very hard when dried and remain so when cold. Binders containing resinous products make the cores quite soft when dried and hot, but such cores develop strength and hardness upon cooling. Certain binders are readily soluble in water, and can therefore be readily mixed with the sands, absolute intimate contact with the sand grains being thus ensured. Molasses is one of these, but used alone is subject to fermentation, with a consequent reduction of its binding properties, and, moreover, during the drying of the cores there is a tendency for this to boil out unless very careful temperature control is maintained.

However, by judicious mixing with suitable ingredients, this trouble can be entirely prevented, and very satisfactory cores obtained with a minimum of trouble. Sawdust or manure is often used to open up the sand—the combustible particles burning out in the drying of the core and casting of the metal thus providing a free passage for the gases. Very satisfactory cores can be produced with these ingredients, but great care must be taken in venting, and such cores are often difficult to remove from the casting.

Sands without Bond.

Most recent developments in core-making have been with purer sands than the ordinary red or yellow sands, the sands being of practically pure silica. The object of using this sand and a binder is to provide a core sand made of silica grains, each of which is coated with a film of binder, the whole resulting in a homogeneous freely-vented mixture. Generally, sea or river sand, free from impurities, is used after being sieved and separated from contaminations of shell and pebble, etc.

The chief and best-known binder is linseed oil, and the majority of special core oils, pastes, compounds and binders are made from a linseed-oil base. Very delicate cores and cores for steel

* A Paper read before the Sheffield Branch of the Institute of British Foundrymen.

moulding require a larger percentage of oil than more straightforward simple cores and cores which are not subjected to such high temperatures and severe cutting action of the metal. For general cores, only one part of oil to 40 parts of sand by volume may be satisfactorily employed, but for the more delicate cores and cores for steel casting the proportion is more often in the neighbourhood of 1 to 20 to 24.

It is better to dry the sand before adding the oil, thus ensuring more accurate proportioning and, moreover, a better coating of the sand grains. Linseed oil alone produces cores that are weak and incapable of being handled in the green state.

A valuable property of certain core binders is that of enabling it to be handled in the green state. This bond is generally imparted by the use of flour and starch products, dextrines and other similar materials, and usually these are used in conjunction with linseed oil in certain definite proportions. Many proprietary core pastes and core compounds are on the market containing definite proportions of these and other ingredients, and usually their value has been proved by practical experiment, after which a definite recipe is worked out and adhered to so that the purchaser is definitely assured of a consistent mixture. To ensure complete success when using oil-sand mixtures it is necessary to have thorough and complete mixing of the sand and binder, in order to obtain uniform and intimate coating of the sand grains.

This coating should be a mere film in order to preserve the minute open spaces between the sand grains. Mixing by hand gives uneven results, and it is undoubtedly more satisfactory to employ a mixer, preferably of the paddle type. The expense of this type of machine is very small, and is undoubtedly cheaper than hand-mixing in the long run, in addition to the superiority of the mixing action. Two specially-shaped paddle blades rotate continuously in the trough body, the edges of the blades touching and scraping the sides and bottom, thus mixing and turning the sand and oil over and over until thoroughly intermixed. The machine can be tilted and emptied whilst the paddle blades are rotating.

The advantages of oil-sand cores over the other types are the reduction, and in some instances the elimination, of core irons, owing to the greater strength of the cores as against those made with naturally-bonded sands; cheaper and simple productions; and, further, the ease with which cores can be removed from the castings in the fettling process, assuming that correct mixtures are used. Properly-dried oil-sand cores are hard and strong, easy to handle without crumbling or breaking, and yet easily removed after casting.

Drying of Cores.

It is apparently a simple matter to drive out the moisture and thoroughly dry the cores, but a study of the effect of various methods of drying and the influence of drying temperature has clearly shown the necessity for considerable care to secure efficient drying. Early methods of drying involved intense heating, and resulted in baked cores, which were very brittle and liable to internal cracks and fractures. Slower drying, with efficient and complete temperature control, has resulted in improved and more satisfactory cores. The time required for drying depends upon the size and character of the core. Small cores can be dried at a higher temperature than large cores. The following can be taken as a general guide for drying temperatures:—225 to 265 deg. C. in sections up to 2 in. thick, approximately, and 200 to 220 deg. C. for sections heavier than 2 in. thick.

An examination of the various cores produced from different binders leads to the conclusion that one baking temperature is not entirely satisfactory in every case. There is a reasonably wide margin over which it may vary without seriously impairing the value and strength of the core.

Linseed oil does not give the best strength until dried at a temperature of 230 deg. C., but any very much higher temperature will begin to destroy the binding properties. This is as it should be, as a core should gradually char and the binder be destroyed by the iron which has set round about it in the process of casting.

Dextrine binders or core gums exhibit this property best of all, carbonisation being quite pronounced at temperatures above 200 deg. C. Water-soluble binders (such as molasses and liquid binders(give the best results at temperatures about 180 deg. C., but are reasonably satisfactory at temperatures from 150 to 190 deg. C. The correct temperature, however, appears to be between 180 and 190 deg. C., as, in spite of the reasonably good strength at lower temperatures, the moisture absorption of these cores is greater and cause subsequent softening, this being very detrimental to the storing of such cores for a long period, and prevents their insertion in the mould overnight prior to casting. Dextrine binders may be baked at the same temperature as the liquid binder and molasses binders, and emit a minimum of gas. Flour, which is occasionally used as a binder, gives the best results at about 165 deg. C.

Temperature control can be effected by means of thermometers or recording pyrometers. Large stoves have latterly been realised to be wasteful and expensive, and are to a great extent being replaced by smaller units, thus eliminating the heat and time losses caused by the continued opening and closing of the doors of the larger stoves. Many large drying stoves are simply large brick chambers which have as a heating arrangement an open firegrate from inside the stove, or a closed firegrate outside the stove, the heat being conveyed to the stove by means of flues, and entering by means of parts in the floor or sides of the stove.

In order to make full use of the heated space inside the stove, bogies mounted on rails are used. Cores are then loaded on to the bogies near the core shop and then run into the stove, where they remain until the cores are dried. The hot-air type of stove is a comparatively recent innovation, the procedure being to dry the cores by means of hot air, which is obtained by passing cold air from a fan over a firegrate, and then passing it into the stove, admitting it at various points. This is a decided improvement over the old arrangement of stove and of course permits of proper variation and control of temperature as required.

Oil-Sand Practice.

Oil-sand cores have undoubtedly received a large amount of attention during the last few years, but their use is not so general as one would anticipate. The method is particularly adapted to foundries that are concentrated upon specialised production and repetition work. It is just as necessary to have the correct grade of sand for oil-sand cores as it is to have the correct grade for moulding purposes.

Whilst every precaution is taken in many large foundries to ensure an ideal choice of core boxes, efficient drying facilities under proper control, and efficient and suitable core binders and compounds, the selection of suitable sands is relegated into the background and receives but scant attention. A suitable selection of sands is vitally important, as an immense quantity of waste is often produced owing to the choice of unsuitable sands. The presence of clay in the sand is proved by practical experience and experiment to have the effect of reducing the binding properties of the oil or binder, necessitating the addition of a considerably larger percentage of binder to give the same strength in the core. Generally speaking, the larger the sand grain the more economical will the oil-sand practice be, as less binder will be used in the coating of the grains and in thus imparting the necessary bond to obtain the desired strength.

It is necessary to know something of the effects and advantages of certain binders and also to have a reasonable knowledge of the quality, grain size and chemical composition of the core sand, in order to be able to make a satisfactory choice of binder for use with a certain sand for the production of definite types of cores. Sand which is free from clayey matter should be used with thin binders in order to ensure economy in the use of core compounds, and also the most satisfactory cores from this binder. Using thick binders, a small percentage of clay is permissible in the sand, and a correct choice of sand from the point of view of grain size should be made.

When using paste binders and others of a similar nature, it is generally desirable and intended to add as much bond as possible so as to enable the cores to be handled in the green state, and in consequence finer sands may be used to assist in imparting this bond, due regard being paid, however, to the satisfactory venting of the cores. Useful data for the production of good oil-sand cores have been compiled recently during a period of interesting research which is still in progress.

Dry sand should be used, or at any rate sand with almost the minimum possible moisture content. Oils of the linseed type, and compositions of these, and also mineral oils, should be used with sands having a comparatively coarse and rounded grain, entirely free from clayey matters, fines and alkaline salts. The grain size should, of course, be chosen consistent with consideration for the finish required with castings, and generally this can be obtained for cast iron when using a sand which passes entirely through a 40-mesh sieve, partly through a 60-mesh sieve and which will not pass through the 80-mesh sieve.

Satisfactorily mixed in either a paddle mixer or light mill, this sand should give an excellent bond with a 2½ per cent. mixture. Good results are in some cases being obtained with as low as 1.5 per cent., but this is not general works practice, and is approaching rather to the imaginary than the ideal. Using thick oils, pastes and thick compounds, the sand should be as fine as possible, due regard being paid, of course, to the venting properties of the core. Such sands should contain about 2 to 2.5 per cent. of clayey matter practically free from alkaline salts and moisture in order to obtain a good bond in the green state. In order to obtain this bond it will be necessary to use 3 per cent. of the compound suitably mixed with the sand.

Included in many core mixtures at the present time are appreciably large amounts of molasses and liquid binders. Such core compounds produce extremely good cores and impart an appreciable bond to the core sand, and in general a good core compound consists of a blend of various ingredients calculated to give the advantages of each individual constituent which collectively overcomes the disadvantage that may be obtained by any one of them when used alone. The experience of most foundrymen when using linseed oil alone is that they do not obtain too good a finish, a certain amount of roughness being apparent, owing to the reluctance with which they leave the core box. Generally with linseed-oil cores a considerable volume of gas is given off on casting. At the present time many substitutes and adulterants are on the market for using in conjunction with, or to the exclusion of, linseed oil. Whilst a comparatively good bond is obtained with these, the volume of gas created is exceedingly high and the smell emitted in the foundry is extremely unpleasant.

Molasses is a very good binding medium but does not produce very strong cores, although the gas evolution is considerably less than in the case of linseed oils. The chief trouble with molasses is the fermentation which occurs after a definite period has elapsed, but whilst this action occurs when used alone or with linseed oils, it can be effectively destroyed if used with certain types and strengths of liquid binders

obtainable from certain sources and prepared under certain specific conditions.

The following tables of comparative tests might be interesting and shows the physical strength of cores made with sea sand, and various binders and compounds made in the laboratories of Beecroft & Partners, Limited, with whom the author is associated.

All the mixtures were made using 3 per cent. of binder in order to obtain comparative figures in Table I.

Table I.—*Sand used, Southport sand. 3 per cent. binder. Drying temperature, 180 deg. C.*

Material.	Tensile strength lb. per sq. in.	Transverse strength lb. per sq. in.	Green bond strength in.
Linseed oil (raw) ..	320.5	72.0	1.0
Core gum (special D) ..	160.0	24.2	0.9
Molasses	142.0	20.2	0.9
Liquid binder	120.5	9.5	0.9
Beecroft's green bond, solid	360	75.0	2.2
Beecroft's green bond, fluid	356	102.4	1.4
Beecroft's C.D.B. ..	352	72.65	1.1

These tests have been taken from various mixings made in the foundry, and not from mixings made solely for laboratory tests. It would be quite easy to present a mass of data collected during the past eight years, but that given is quite sufficient to show the comparative values of various core binders and compounds.

Table II.—*Sand used, Southport sand. 4 per cent. binder. Drying temperature, 200 deg. C.*

Material.	Tensile strength lb. per sq. in.	Transverse strength lb. per sq. in.	Green bond strength in.
Linseed oil (raw) ..	358.0	81.5	1.0
Core gum (special D) ..	195.0	32.5	1.1
Molasses	195.0	31.0	1.2
Liquid binder	161.5	18.0	1.1
Beecroft's green bond, solid	469.5	89.0	2.80
Beecroft's green bond, fluid	452.2	109.0	1.8
Beecroft's C.D.B. ..	410.0	80.1	1.4

It is interesting to note that the last binder, *i.e.*, C.D.B., is a very complex binder in its mixed form, but is one that is almost entirely free from fume in the foundry, and is in consequence very much liked by the moulders. Moreover, there is a minimum of gas created by this binder, and, therefore, a considerable amount of trouble is eliminated.

A wide difference of opinion exists as to the advantages of various types of mixers, many claiming that the mortar-mill type of mixer crushes the grains. It is certain, however, that this type of mill produces a larger percentage of "fines," but at the same time a better green-bond strength is generally obtained. It is understood, however, that the additions of oil or core compound tend to reduce the crushing effect of the rollers of the mill by acting as a cushion, and thus act to some extent as a preventive against breaking up. The green-bond strength is, therefore, usually equal, if not greater, in sand mixtures mixed in the mortar mill to those mixed in the paddle mixer. A useful type of paddle mixer incorporates the paddles rotating in opposite directions and having an effective mixing action, turning the sand over and over and rubbing the grains of sand and oil together in such a manner as efficiently to mix and bond the sand.

Sand Renovation.

An interesting item arising out of the subject of core-making is that of sand renovation, *i.e.*, the renovating of used foundry sands by the addition of a suitable medium for replacing the colloidal bond of the sand which has more or less been destroyed by the repeated action of molten metal when in contact with the sand. Thus the sand which has become spent and devoid of bond for moulding purposes can be renovated, and bond added in a similar manner to that in which it is added to core sand.

The material marketed under the trade name of "Corbeerite" is suitable for this purpose, and a number of interesting experiments have been made with this material along the lines mentioned. Considerable laboratory research on sands has been carried out, particularly as applied to core-making, but one which is receiving detailed study at present is the elimination of coal dust from facing sands by the use of certain oils. This is a rather interesting movement, and has so far been accompanied by comparatively satisfactory results, and appears to be one aspect of foundry work which is likely to be developed in the near future.

Sand Testing.

The method used generally in England is that of the green dropping test, in which a bar of sand is rammed up in a core box 12 in. long by 1 in. by 1 in. and pushed over a plate until the overhanging portion falls off. The length of the portion broken off is measured and reported in inches as the green-bond strength. A further test is the transverse test, where a core is rammed up to 6 in. by 1 in. by 1 in. or any dimensions suitable to the size of machine employed, and the strength reported in lbs. per sq. in., tests being made on the dried core. Unfortunately, in this country no standard design is general, and there is in consequence a division of opinion as to the most suitable type of test-piece to employ.

The tensile test is usually made with the type of sample used for cement testing, but the general opinion is that this test is not of very much value. The American Foundrymen's Association some time ago appointed a committee to inquire into the testing methods of moulding and core sands, and a very interesting report was issued giving suggested tests which are being carried out as standard tests in large numbers of foundries in the States, and which have been accepted as standard by a number of the larger foundries in this country.

The Permeability Test is a means of absorbing the venting qualities of sands, and its application is of considerable value in studying the problem of venting sands and its effect on foundry practice.

The Fineness Test is a simple operation, and gives direct information on the fineness of grain distribution of foundry sands, and accurate estimate of the amount of clayey matter present.

The Ultimate Chemical Analysis provides useful information, but is not necessary generally, as the purchases of sand from one definite source will be found to vary but slightly. It is advisable, however, occasionally to have an analysis made in order to ascertain whether any foreign matter or objectionable elements are present. Analyses should, however, be made regularly on sands for steel moulding and on sands intended for the core shop, particularly on those sands high in silica.

Bonding or Cohesive Test.

This test consists essentially of making a bar of sand in a standard mould, using 1,000 grains of sand as used in the foundry or core shop. The sand is rammed, by means of a standard falling weight, in the mould, the sides and bottom of which are loose parts, the bottom part having a sheet of this waxed or oiled paper on to which the sand is placed. The rammed bar is 1 in. thick, with a tolerance of not more than 3 per cent. The waxed paper is of the same width of the base plate of the mould, and has a long portion overhanging the edge of the plate and long enough to be inserted in the slotted shaft of a small motor, which pulls the paper forward slowly at a constant speed of 6 in. per min.

The bar of sand is also brought forward with the paper at the same speed. When the overhanging portion of the bar falls off the motor is stopped—the broken portion of sand being caught in a convenient receptacle so that every particle is retained. This sand is weighed, and the process repeated until as many breaks as possible are obtained in the length of bar. To prevent the last part of the bar tilting, a broad flat weight is placed on it to hold it down.

If the bar breaks fairly uniformly, all breaks are retained. If the first break differs by more than 10 per cent. from the average of the others it should be discarded. Usually carefully mixed sands will have very uniform breaks. Add the weights of all retained breaks together and divide by the number of breaks. This gives the average breaking weight for the bar. This is repeated on another bar of the same sand and the final average obtained. The bonding strength is expressed in terms of the actual weight in grains of the average breaking strength of the bar, including moisture.

The Permeability Test.

The apparatus consists of a container for the sand, 2 in. dia. by 5 in. deep, the sand being rammed in under a constant weight so that the extent of ramming is always constant. A cylindrical copper tank, provided with a vertical air outlet, and partly filled with water is used for generating pressure by means of a bell in the copper tank. As the bell sinks into the water contained in the tank it forces air out of the outlet mentioned. The sand container and sand are placed under the tank on to the outlet, which is provided with a rubber stopper to fit the container. A monometer tube is also provided on the apparatus for registering the pressure. This can be regulated and is usually taken about 1.1 ozs. per sq. in. The air is forced through the sand specimen and the amount passing through recorded. The degree of permeability is found from the formula

$$\text{Permeability} = \frac{\text{cms}^3\text{. of air} \times \text{height of specimen}}{\text{grains pressure} \times \text{area of specimen cms}^2\text{.} \times \text{minute}}$$

The figures obtained are comparative and extremely useful if tests are being made regularly.

In conclusion, the author desires to express his thanks to his principals, Messrs. Beecroft & Partners, Limited, for the assistance given in the preparation of this Paper, and to Messrs. J. Blakeborough & Sons, of Brighouse, Messrs. Calvert & Company, of Huddersfield, and Messrs. Baker, Perkins, of Peterborough, for the opportunity of showing photographs of actual cores which have been taken in their foundries, also, in the case of the latter firm, the assistance given on the testing of sands.

Foundry Teachers in Conference.

The foundry department personnel of American technical colleges are to meet on May 14 for their annual Foundry Instructors' Dinner, held in connection with the American Foundrymen's Association Convention at Cleveland. This event has become a regular and well-attended feature of the foundry convention. It was organised for the purpose of bringing together the foundry instructors of the various engineering schools at a time when they might also take advantage of the convention sessions and exhibition of foundry machines and equipment. This year the dinner meeting will be addressed by a well-known foundryman on the subject "The Place of the Engineering Graduate in the Foundry Industry of To-day." Mr. A. E. Wells, director of Engineering Shop Laboratories, Cornell University, Ithaca, New York, will preside.

XUM

Foundry Training Abroad.

By J. G. Pearce, M.Sc. and M. H. Pearce, M.A.

IV.—America.

Characteristics of American Conditions.

The significance of foundry training in America is of a rather different nature from that of foundry training in European countries. There are three main reasons for this, in the first place, although it is a matter of common habit to speak of America as we speak of France or Germany, only those who have actual personal knowledge of the United States realise fully either their extent or their heterogeneity. At the present stage of development, therefore, it would be too much to expect any federal scheme of foundry training, and in fact no such scheme exists. In the second place, the labour supply is of a correspondingly heterogeneous nature, containing a large element of low-grade labour of mixed foreign origin, including negroes, and immigrants not yet one generation removed from the habits of certain European countries where the standards of life and work are very low. Moreover, there is practically no reserve of traditionally skilled craftsmen such as we possess in England. In the third place, American industry is organised upon lines that recognise with much greater frankness than is acceptable over here the all-powerful character of the money standard. The difference arises from the fact that even the biggest industrial enterprises in Europe are not yet completely dissociated from the traditions of paternal benevolence and disinterested apprenticeship that ruled in the days before the factory system. American industry, broadly speaking, never knew those days. Over here we still pay at least lip-service to the older tradition, however much we may impede our progress by so doing, and we would, for example, hesitate to promulgate such a statement as this: "Only those subjects which make it easier or cheaper to do the jobs should be taught." It is possible to argue that our own broader view has its advantages.

Fig. 1.—Foundry Apprentices at the Milwaukee Steel Company, Milwaukee, Wisconsin.

Apprenticeship in American Foundries.

When we come to study the actual conditions of foundry training in America, we find that a large number of works and foundries have developed individual schemes to meet their particular needs, stimulated by the difficulty of obtaining labour, and especially good-class labour, unless they can offer some such bait as an attractive apprenticeship scheme. Naturally there are certain similarities between these schemes, and latterly attempts are being made by organisations more or less national in scope first of all to investigate their extent and character and subsequently to co-ordinate them as far as possible.

The usual methods are in use to attract boys into the trade, but developed as might be expected in accordance with the importance attached to schemes of vocational guidance throughout the States. The course usually lasts four years, which is sometimes shortened to three for better educated or unusually able boys, and sometimes also as a reward for good work. It is also not uncommon to find a two-year course for University graduates, who may be regarded as potential executives. An example of this is found in the Milwaukee district. Where the course covers less than four years without any such explanation, it is usually because it covers the work of one small foundry instead of extending over the whole range of foundry work in the way that is possible for apprentices in a large plant or one that co-operates with a number of others in the district. In this connection it must be remembered that American foundries specialise to a very much greater extent than British foundries, so that the individual works is rarely able to offer a complete survey of foundry work in all its branches. This acute specialisation also accounts for the willingness of foundries to co-operate in educational schemes, even when outsiders may benefit, because they are not as a rule in direct competition with each other. The rates of pay for apprentices vary a good deal, but they are as a rule carefully fixed and graded to represent a definite and rising percentage of the current journeyman wage. Wage-rates in the States differ so widely from our own, chiefly on account of the much higher cost of living, that quotations would be of little use. An hourly bonus for good work is sometimes added.

Apprenticeship Courses.

The apprentice course consists of shop-training and of class-room instruction, the co-operation of a number of foundries being considered highly desirable in the first case for reasons already stated. Many elaborate schedules are available, showing the exact time to be spent by the apprentice on a given job before he proceeds to the next, the progression being arranged to ensure as far as possible that the work always reaches a commercial standard—that is to say, that the job is within the capacity of the apprentice. An example of advancement by number of hours is as follows:—Helping moulding and machine moulding (each 400 hrs.), bench moulding (650 hrs.), large cores (700 hrs.), small cores and miscellaneous floor work (each 650 hrs.), heat-treating and furnace work (each 650 hrs.), green- and dry-sand moulding (each 1,200 hrs.), sweep moulding (850 hrs.), casting, checking, sand mixing, sifting, crane work, time study, night work, etc. (1,110 hrs. altogether), and chipping room (750 hrs.). This is fairly typical of the allocation of time to different jobs.

The class-room instruction generally takes place in working hours—a difference from the current European plan, that is one of the advantages of recognising the frankly commercial value of apprenticeship. It usually occupies about four hours per week, occasionally longer. This instruction may be provided in a class-room in the individual works; or it may be provided in a class-room or set of class-rooms privately organised and shared by a group of co-operating works; or it may be provided by the local educational authorities in consultation with and to meet the needs of a similar group. The latter is considered the most satisfactory arrangement, partly because its connection with the educational machinery enables the provision of better class-rooms and equipment out of the appropriate funds. Teachers' salaries can also be met out of public funds on a minimum of four hours' work per week for thirty-six weeks in the year. Great stress is laid upon the choice of instructors, who have a practical connection with the industry and upon their ability to teach boys rather than subjects. A study of the subjects taught, however, reveals a much more frankly utilitarian bias than is usually to be found in this country. The general plan of instruction generally falls under the following six heads: blue-print reading, shop sketching and drawing; shop mathematics; science related to shop operations; economics; trade subjects, *i.e.*, materials, tools, equipment, safety practices, and industrial relations; English as required. This utilitarian bias, incidentally, is dictated as much by the demands of the apprentices themselves as by the policy of the employers. One Milwaukee foundry arranges its courses as follows: related shop technique, 336 hours; shop mathematics, 252 hours; economics, 84 hours; chemistry, physics, and mathematics, 84 hours; and a series of special talks on such subjects as shop etiquette, big business, citizenship, etc. The related shop technique includes, in addition

to the study of core-making, mixing, etc., foundry chemistry, 16 hours, and metallurgy, 40 hours.

The trained apprentices or apprentice graduates, as they are commonly called, remain very largely in the trade for which they have been trained, and this is a highly significant point in a country where there is so much mobility as between different grades and types of employment, and where, in fact, a man may be an engineer one day and a movie actor the next without causing the least surprise. Many foundries retain from 75 to 100 per cent. of the boys they have trained, and in all cases where apprentice schemes are in operation they appear fully to supply the requirements of the individual foundry and to contribute a certain amount of trained labour to others in the locality. This is another feature that would be unacceptable in Great Britain, but which is perfectly practicable in a country where a high degree of specialisation exists.

The illustrations show apprentices at work in three entirely different plants, where typical schemes are in progress.

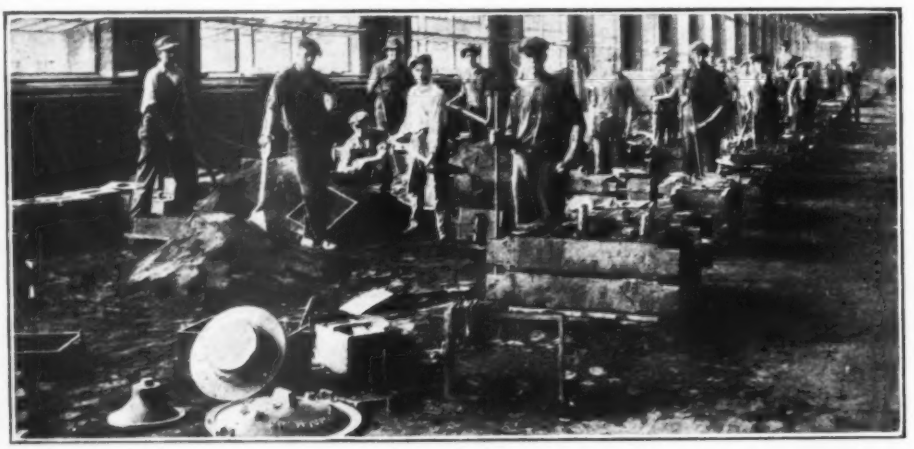

Fig. 2.—Apprentice Moulders at Messrs. Allis-Chalmers Manufacturing Company.

Co-ordinating Efforts.

The American Foundrymen's Association is making an important contribution to the problems of foundry training by the organisation of periodical apprentice contests, arranged by its Committee on the Training of Apprentices. These contests are organised first locally and then nationally, and they cover grey iron, steel, etc. In the pattern-making division points are awarded for accuracy, "mouldability," workmanship, and time, and in the moulding section for general appearance, soundness, time, gating, and risers. Points to which special attention is directed refer in general to the practical merit and usefulness of the work. It is stated, for example, in the pattern division that a dimensional mistake rendering the pattern unfit to produce a saleable casting is ground for rejection. These contests are rewarded by money prizes as well as certificates.

Fig. 3.—Apprentices and Journeymen working together on Patternmaking at Messrs. Frick Company, Waynesboro, Pa.

The National Founders' Association has appointed a Director of Education, under whose direction elaborate surveys and schemes of foundry apprenticeship have been drawn up. These surveys emphasise that the foundry industry in America already contains a number of apprenticeship schemes, although they are not all recognised as such. In this connection an interesting distinction is drawn between apprenticeship and "up-grading," apprenticeship being the correct description when the production of commercial castings is made incidental to the training of boys, and "up-grading" when the process is reversed and the training of boys is made incidental to the production of commercial castings.

Advanced Training for Foundrymen.

Provision for training in foundry work in the colleges and universities of the United States is singularly inadequate. In spite of a total number of 5,600 foundries over the period 1926-1928, not one of the 168 colleges that give engineering courses of one sort or another devote proper attention to foundry requirements. Some 39 of these institutions provide a short course in foundry work, but it usually consists of four to six hours per week for one term devoted to pattern-making and foundry topics.

Conclusions.

The American founder has been obliged by labour conditions to institute his own apprenticeship schemes to meet his own requirements, and their study is necessarily of great interest. Training developed in this way, however, as opposed to training developed by a central or State authority, is of a much more severely practical character. It appears also to be almost entirely divorced from current research work, thereby lacking the very real educational influence of the big European research institutions and training centres where research is regularly in progress.

Messrs. Edgar Allen & Company, Limited, Imperial Steelworks, Sheffield, have acquired from Messrs Ord & Maddison, Limited, of Victoria Works, Darlington, that portion of their business relating to rotary screens, rolls, stonebreakers and tar-macadam mixers. In future Messrs. Edgar Allen & Company will undertake the manufacture and sale of these machines and the various fittings in connection with them Messrs. Edgar Allen & Company already possess their own standard designs of screening and crushing machinery, but by acquiring the above business they are now able to offer a larger range of machines.

Recent Metallurgical Research.

At a meeting of the Institute of Marine Engineers held in London on April 8, Mr. John Nicol (chairman of Council) in the chair, Mr. S. L. Archbutt read a Paper on "Recent Metallurgical Research in Relation to Marine Engineering," in the course of which he reviewed the progress made during the last decade in both ferrous and non-ferrous metallurgy.

With regard to materials for use at high temperatures, one of the most important requirements in this connection (continued the author) is ability to withstand prolonged loading. Some of the most interesting and important research in recent years has been directed to this requirement, stimulated by what practically amounts to a discovery that under prolonged loading at high temperatures, flow or creep can occur even in the strongest materials known, so that an engineering part may ultimately fail at a stress very much below the tensile strength of the material, or even below its apparent limit of proportionality. This being so, the tensile strength of the material at high temperatures as determined in the ordinary way by short-time loading can no longer be relied upon by the engineer as a guide on which to base a factor of safety, and he requires some other property. The question arises as to what this property is to be. The view has been expressed that the limit of proportionality must be used—that above this stress, creep will be continuous and failure eventually occur.

On the other hand there is the view that within a certain temperature range, there is a definite upper limit of stress (for each temperature) above which creep will occur leading to failure, but below which creep will ultimately cease, so that after a certain degree of permanent strain has occurred, the part may be expected to have a very long life. This upper limit of stress which a material will withstand without ultimate failure (or at least for a very long time) is termed the limiting creep stress—it may be regarded as the ultimate strength of the material at the temperature in question having regard to the effect of time, and might be called the "time-ultimate." This limiting creep stress would appear to be the property which should take the place of the short-time tensile strength for design purposes at elevated temperatures.

Continuing, the author referred to the development of new materials and the industrial application of alloy steels in steel plants, dealing at length with the high-temperature properties of some of these new alloys. Various phenomena were outlined, including "age-hardening," "modification," "pin-holing" or "speckling."

Corrosion and the nitrogen-hardening of steel were also dealt with.

Empire Mining and Metallurgical Congress, South Africa.—In the course of his presidential address, delivered at Cape Town on March 24, 1930, on the occasion of the opening of the Third (Triennial) Empire Mining and Metallurgical Congress, Sir Ernest Oppenheimer, M.L.A., said that in the year 1860 there were only two miles of railway in South Africa, namely, the connecting link between what was now called the Point at Durban Harbour and the town of Durban. In 1876 the mileage had only increased to 156 miles; in 1885, following the construction of the lines to De Aar and thence to Kimberley, the mileage was 1,120; whilst in 1895, owing to the establishment of railway communication with Johannesburg from various points, the mileage was 3,529. Subsequent to the Anglo-Boer war, railway construction was very rapid, and by 1909 the mileage in operation had increased to 7,403, whilst to-day the Union mileage was 11,233, excluding private railways, which had a total length of 684 miles. In addition, railway systems had been established and were being continually extended in Southern and Northern Rhodesia and the Belgian Congo, chiefly as the result of mineral development.

Famous Shipyard Entertains Foundrymen.

Recently a visit was made to the works of the Wallsend Slipway & Engineering Company, Limited, by the members of the Newcastle Branch of the Institute of British Foundrymen. The party was received by Mr. Taylor, works manager, and Mr. McBride, and other members of the staff, who showed them round the works.

For three or four years from the formation of the "Wallsend Slipway Company" they were engaged solely in the repair of ships of a size which could be accommodated on their two slipways. Numerous extensive repairs were carried out to ships within their capacity, but it was not until the year 1895 that they were able to deal with vessels of a large size. It was in that year that their graving dock, measuring 540 ft. in length, was formally opened. Following upon this event, they had a variety of ships in dock, comprising merchantmen of all types, and warships for the British and foreign navies, to which repairs of a more or less extensive nature have been executed. The ship-repairing branch has adequate equipment in the shape of modern plant, tools and capacious travelling cranes and up-to-date methods prevail.

Fig. 1.—General Erecting Shop.

Commencing with a shop of modest proportions, it was found necessary to erect an entirely new building for the boiler-making department in 1881, and to further extend it in 1904 to accommodate the gigantic boilers of the Cunarder "Mauretania." In addition to large overhead travelling cranes up to 100 tons capacity, which are driven electrically, machines for flanging, drilling, riveting and other operations connected with the manufacture of boilers are installed. Cylindrical boilers having a working pressure of 300 lbs.—and in one case 312 lbs.—per sq. in. have recently been constructed.

In one year the company attained a maximum output of 346,310 indicated horse-power, which placed them at the head of the output list of the world's marine engineers. The most important British warship which they have engined since the Armistice was concluded is the battleship "Nelson," which was commissioned in the year 1927. The geared turbine engines are of very high power, and as a result of improvements which were effected in design the highest economies were attained on the official trials of the vessel, not only at the maximum power of the turbines, but also at low powers. Incidentally, it might be mentioned that they have been supplying machinery equipment for H.M. Admiralty for 30 years. Their first marine Diesel engine was built and put into service in 1915.

The Shaw-Savill liner "Zealandic" was fitted with heavy oil engines of the Wallsend-Sulzer type. These are two in number, and are two-stroke cycle oil engines, each having six cylinders of 31-in. bore by 43-in. stroke. The engines develop a combined b.h.p. of 7,450 in regular service at sea, while on trial it was required that power of at least 10 per cent. in excess of this should be obtained. An air compressor for supplying injection air is placed at the forward end of each engine, and is driven by a crank forming an extension of the main crankshaft. The engines are noteworthy for their low height, which has been achieved by the adoption of a small stroke-bore ratio. The bedplate is of deep section, and is of the popular flat-bottomed "tank top" pattern.

As far as oil burning on board ship is concerned, they are regarded as the pioneers in this connection. It is now more than 45 years ago since they first began to experiment with oil-burning arrangements. Their efforts were rewarded with success from the very commencement, and after a good deal of research work they have evolved systems which are equally applicable to land as to marine boiler furnaces, *i.e.*, Wallsend-Howden pressure, Wallsend-Howden steam jet and Wallsend low air pressure. Each has its advantages, depending upon the precise purpose for which it is required.

One of their latest innovations concerns turbine machinery, whether originally constructed in their own works or elsewhere. They have already been responsible for the transformation of a number of vessels fitted with turbine engines whereby a gain in speed and fuel economy resulted. Since acquiring a licence to manufacture turbines under the Bauer-Wach patents they have built several sets of Bauer-Wach turbine installations for old and new ships.

After tea, which was kindly provided by the company, Mr. A. Logan, on behalf of the party, expressed their thanks to Messrs. The Wallsend Slipway & Engineering Company, Limited, for allowing them to visit the works, which were famous throughout the country and 21 years

(*Continued on page* 313.)

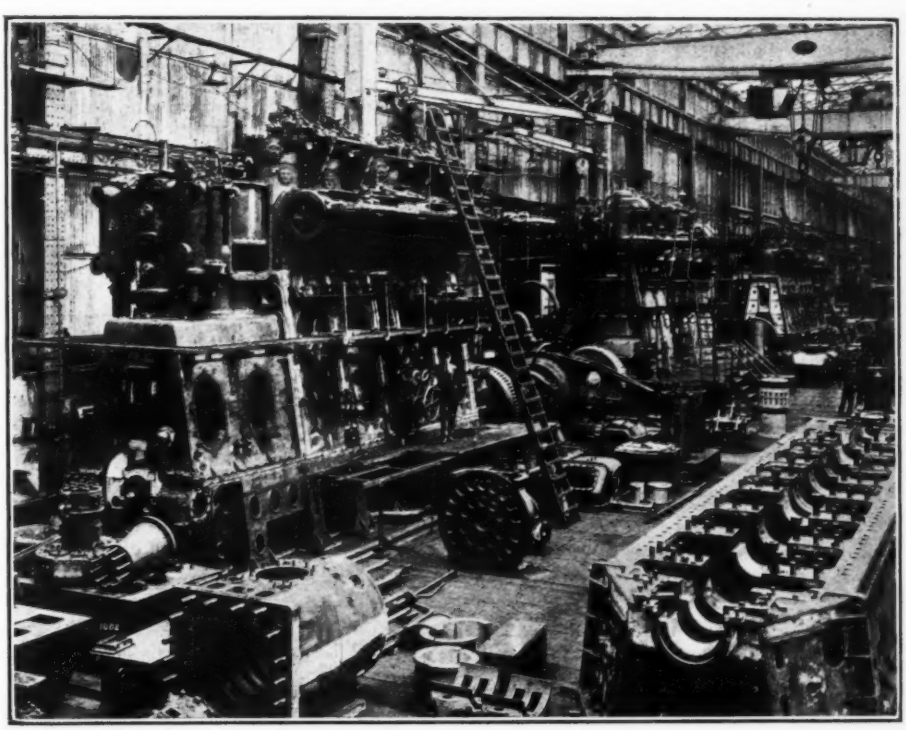

Fig. 2.—Marine-Engine Erecting Shop.

I.B.F. Elects New Members.

At the meeting of the Council of the Institute of British Foundrymen, held at the Midland Grand Hotel, London, on April 12, the following were admitted to membership:—

As Subscribing Firm.

Mavor & Coulson, Limited, 47, Broad Street, Mile End, engineers.

As Life Member.

Thos. Shanks, iron and steel founder, Cruikshank & Company, Denny.

As Members.

F. J. Battersby, works manager, Union Foundry, Derby; Wm. N. Cook, B.Sc. (Tech.), brass founder, Eagle Brass Foundry, Salford; S. Glover, foundry manager, Matterson, Huxley & Watson, Limited, Coventry; H. Littley, foundry engineer, Phœnix Works, Swan Village, West Bromwich; F. N. Lloyd, steel founder, F. H. Lloyd & Company, Wednesbury; A. Macdonald, foundry manager, Grayson, Rolls & Clover Docks, Limited, Liverpool; H. Roberts, foundry engineers' representative, Fordath Engineering Company, Limited; J. F. Wood, B.Sc., general manager, United Steel Company, Wellingborough; T. Fitzpatrick, works manager, Kelvinvale Mills, Maryhill; T. M. Service, metallurgist, Parkhead Forge, Glasgow; G. P. Thompson, manager, Kent Brass Foundry; A. B. Everest, B.Sc., Ph.D., metallurgist, Mond Nickel Company, Millbank, S.W.1; H. W. Forster, foundry manager, W. Shaw & Company, Middlesbrough; Wm. Goodall, foreman pattern-maker, Wm. Shaw & Company.

As Associate Members.

E. O. Daniel, engineering works manager, Baglan Engineering Works, Briton Ferry; J. G. Gould, foreman, G. Brown Bros., Stockton-on-Tees; Wm. Jackson, foundry foreman, Garton & King, Limited, Exeter; F. H. Lawson, draughtsman, Blakeborough & Sons, Brighouse; E. Lloyd, iron moulder, C. P. Kinnell & Company, Thornaby-on-Tees; F. S. Perkins, foreman moulder, Cowlishaw, Walker & Company, Stoke; H. C. Pullin, iron moulder, A. Marshall Hunt & Company, Bristol; S. Wade, moulder, Holmes, Limited, Huddersfield; L. W. Bolton, metallographist, B.C.I.R.A.; W. S. J. Collier, founder, H.M. Dockyard, Devonport; T. Crombie, assistant foreman moulder, N. Brit. Steel Foundry, Bathgate; Wm. McDougall, metallurgist, Hardie & Gordon, Glasgow; F. C. Berry, moulder; R. A. Buchanan, foundry assistant, Niagara Foundry Company, Bilston; R. B. Cheetham, foundry manager, Sun Foundry, Derby; H. A. Curnock, works office assistant, Tangyes, Limited, Birmingham; W. Dresser, M.C., production engineer, Richardsons, Westgarth & Company, Hartlepool; J. A. Fenton, castings inspector, English Electric Company, Rugby; C. J. Fettis, iron moulder; S. C. G. Fitter, foundry draughtsman, Daimler Company, Limited, Coventry; Chas. Guest, foundry manager, Northampton Foundry Company, Limited; G. Hickman, iron moulder; J. M. Kenyon, apprentice, H. W. Kearns & Company, Broadheath; L. Lawson, iron moulder, D. King & Sons, Possilpark, Glasgow; J. H. Morris, foundry foreman, Horsehay Works, Shropshire; W. J. Moss, foundry student, Woottons Bros., Coalville; H. A. Robinson, moulder; L. Smith, patternmaker, R. W. Crosthwaite, Limited, Stockton; G. F. Taylor, coremaker, Belliss & Morcom, Birmingham; F. Williams, B. P. Shenton, West Bromwich; C. S. Woodhall, foundry manager's assistant, Vowles Bros., Limited, West Bromwich; Wm. Waby, foundry foreman, Humphrey & Wyn; G. F. Wright, chemist, Head, Wrightson & Company, Limited, Stockton-on-Tees.

As Associates.

D. Guthrie, foundry apprentice, Ashmore, Benson & Pease; Thos. Miller, moulder; W. W.

(*Continued at foot of Column* 3.)

The Turn of the Tide.

By "Onlooker."

The almost sensational decline in the Bank of England discount rate has been hailed by many as a certain sign of better times for everyone connected with business, but while cheap money cannot fail to be of inestimable value to manufacturers, it is not in itself a certain cure for the troubles which beset commerce. Given the opportunity to employ such cheap funds, traders are, of course, infinitely better off under conditions of financial stringency, but in the absence of initiative, bred of confidence in the future—immediate and distant—the gift can hardly be employed to the full. The main influence at work in bringing down the Bank rate here has undoubtedly been monetary ease in New York, and in another six months it is more than likely that American trade will be again well on the up grade and call money at 1 per cent. only a memory. Too much stress therefore should not be laid upon the existing plethora of cheap money.

The lowering of our Bank rate here has, however, acted as a much-needed check to wave after wave of pessimism, and although at the time of writing the Budget was certainly acting as a deterrent to enterprise, there are plain indications that sentiment has improved, and following on that necessary preliminary will come a slow, but it is to be hoped steady, change for the better in general trade. An important point frequently overlooked during these periods of stagnation is the fact that buying power is being strengthened through the abstention from purchasing by the community; for since the world must go on, there is necessarily a time limit to these lulls. For a variety of reasons, some political and some financial, the check to demand so far this year has been deliberate, and it only needs a hint of certainty in the place of galling uncertainty to bring about quite a sharp revival in demand.

The Metal Market.

As far as our metals are concerned, signs are not wanting that the tide has turned, and that after months of falling markets and gloomy prognostications merchants and consumers are beginning to realise that the bottom has not altogether fallen out of things, and that it is still possible to turn an honest penny by sitting up and taking a good look round. The copper statistics have, of course, been very unfavourable, and in this they are but a reflection of the falling-off in demand, both in Europe and in America, for the red metal. Deliveries to domestic consumers in the States from November to February were well below the monthly average for 1929, and the same may be said of exports, although relatively these figures were not so bad as the domestic statistics. Latterly, however, there has been an improvement in American demand, and although the brass makers are still not enjoying much of this change for the better, the electrical trades are taking considerably more metal. Eighteen cent copper has been blamed for this slump in demand, but since consumers are buying hand to mouth and thus safeguarding themselves to a great extent against a fall in the price, it is questionable whether the quotation has much to do with it. In any case, the exporters are understood to hold that a lower price would not necessarily mean more business. Whether the price does eventually go down or not, it seems quite likely that copper consumption has now taken a turn for the better and will continue to expand as the year goes on.

The Tin Position.

Tin has latterly shown signs of an upward movement, and although it is doubtful whether the quotation will achieve a climb without frequent halts on the way, it seems safe to predict that the end of the long fall has come. Tin's trouble, and it is a very serious one, is the presence of onerous stocks in this country and visible supplies which are somewhat overwhelming in magnitude. Curtailment of production, announced some three months ago, has hardly as yet made itself felt, but 30,000 tons per annum is a good slice out of the world's output, and since consumption in the States is slowly mending this factor ought to begin to operate very soon. The difficulty about a rise in tin to a higher level is likely to be manipulation on the part of groups, which will force the quotation up too quickly and bring about reactions which will destroy confidence and hold back eventual recovery. However, a start has been made on the upward trend and, in spite of setbacks, this ought to continue.

Spelter Position.

Spelter at the time of writing has moved up a good twenty shillings from the bottom, has gone above lead for the first time in some six months and shown that it is not as "down and out" as some supposed. Unfortunately, there are signs that the movement has gone rather fast, for stocks are very plentiful and the American position is not at all good just now. Actually a better sentiment has been engendered on account of the meetings held by members of the defunct Zinc Cartel, but since *no* real agreement seems to have been reached, this optimism is somewhat premature. One of the chief obstacles to restriction of production in zinc is the cheap electrolytic process, which depends to a marked degree upon continuous operation. Below £20 there certainly cannot be much profit for zinc producers, but as a body they seem to be loath to make a start on the all important job of curtailing output.

Lead is now a very steady market, and a further fall is extremely unlikely, while odd half-crowns added to the price from day to day have hoisted the quotation somewhat above the worst. As with the other metals, there is a quantity of lead about, and secondary metal plays an important part in any summing up of the situation, but demand is reasonably good, and the comparatively low level at which the metal now stands can hardly fail to be an incentive to consumption when some rift at last appears in the clouds of depression overhanging the whole world of commerce to-day.

British Empire Steel Corporation.

Reorganisation Scheme.

The reorganisation and consolidation of the capital structure of the British Empire Steel Corporation, Limited, and its subsidiary companies, the Dominion Steel Corporation, Limited, and the Dominion Iron & Steel Company, Limited, are announced. Under the plan the shares and securities of these companies will be exchanged for shares and securities of a single new company, to be called the Dominion Steel & Coal Corporation, Limited. The plan involves the drastic reduction of the present capital and the substitution of new stock. The exchange of existing shares for shares in the new company will be as follows:—British Empire Steel Corporation first preference, three and a quarter new shares for each existing share; British Empire Steel Corporation second preference, one new share for each two existing shares; British Empire Steel Corporation common stock, one new share for five old; Dominion Steel preference, four new shares for one old; Dominion Iron & Steel preference, three new shares for one old. A shareholders' meeting is to be held in Montreal on May 15 to ratify the reorganisation scheme.

I.B.F. Elects New Members.

(*Continued from Column* 1.)

Richardson, iron moulder, Ashmore, Benson & Pease; H. W. Smith, iron moulder, W. Sisson & Company; G. B. Taylor, apprentice engineer, Ashmore, Benson & Pease; Wm. Holden, iron patternfitter, Howard & Bullough; E. H. Nubley, apprentice metal founder; J. D. Moffat, apprentice patternmaker, F. Helm, Limited. Padiham.

The Lesser Iron- and Steel-Producing Countries in Europe.

I.—RUSSIA, CZECHO-SLOVAKIA, AUSTRIA AND HUNGARY.

Comparatively little attention has been paid to the progress which has been made by the less-important iron and steel industries on the Continent during recent years. It is not often, for example, that Russia is taken into account when the position of the iron- and steel-producing countries in Europe is under discussion, and yet Russia is at the present time producing more pig-iron and ingot steel than Belgium, Luxemburg or the Saar—three countries which occupy a prominent position in the iron and steel industry. It is therefore the intention of this article to make a brief survey of the present position and potential development of the iron and steel industries in those European countries which are often considered of little importance from this point of view.

Although they may not contribute a substantial percentage of the total world-output of pig-iron and steel, they exercise an appreciable effect on the export trade of the major iron- and steel-producing countries in Europe. That the latter are fully alive to the possible repercussions on their business of developments in the newer iron- and steel-producing countries is evident from the fact that they have initiated negotiations on various occasions with certain of the smaller countries with a view to coming to some mutual agreement regarding reciprocal protection of markets.

Table I shows the output of pig-iron and ingot steel of eight of the minor European iron- and steel-producing countries, from which it will be seen that they have made substantial progress during recent years. In the case of pig-iron the aggregate output last year showed an increase of 15.7 per cent. over 1928 and 25.4 per cent. over 1927. In the case of steel the aggregate increase was 12.3 per cent. over 1928 and 30.3 per cent. over 1927.

Table I.—*Output of Minor European Iron- and Steel-Producing Countries.*

	Pig-iron.			Steel.		
	1927.	1928.	1929.	1927.	1928.	1929.
	(In thousands of tons.)					
Russia ..	2,920	3,220	4,200	3,530	4,180	4,700
Italy ..	530	560	580	1,570	1,930	2,200
C. Slovakia	1,300	1,540	1,620	1,600	1,710	2,110
Poland ..	610	670	710	1,230	1,410	1,450
Spain ..	600	560	610	650	780	800
Austria ..	430	450	460	550	630	700
Sweden ..	450	430	480	490	570	670
Hungary ..	290	300	280	460	480	500
Total ..	7,130	7,730	8,940	10,080	11,690	13,130
Other Continental countries	30,220	30,000	32,480	32,190	32,080	34,390
Total Continental Europe	37,350	37,730	41,420	42,270	43,770	47,520

During the past three years, production in these eight countries has thus increased at a substantially higher rate than in the rest of the Continent, for whereas in 1929 the production of the eight smaller countries increased by 25.4 per cent. over 1927 in pig-iron and 30.3 per cent. in steel, the increase in production in the rest of Europe in 1929 only amounted to 7.5 per cent. over 1927 in the case of pig-iron and 6.8 per cent. in the case of steel. Last year the eight minor countries were responsible for 21.6 per cent. of the total pig-iron and 27.6 per cent. of the total steel output of the Continent of Europe.

These national industries, of varying sizes and importance, have therefore attained a position of considerable significance in the general iron and steel industry on the Continent. It is true that, generally speaking, these countries at the present time are primarily concerned with their respective domestic markets, yet, in so far as they increase production and supply their home needs from domestic sources, the difficulties of countries formerly exporting to these markets must be increased. These difficulties are still further intensified by the almost inevitable growth of a protectionist nationalist spirit which aims at securing the home market for the growing iron and steel industry.

These less important countries obviously do not possess the benefits enjoyed by the older Western European steel-producing countries, either from the point of view of technique or a favourable geographical position; but they have one important advantage in having available plentiful supplies of extremely "cheap" labour. The price of labour is comparative, and while iron and steel wages in Germany are some 75 per cent., and in France, Belgium and Luxemburg only 50 per cent. of the British level, wages in such countries as Russia, Poland and Italy, for example, are lower still. For instance, German engineers who have recently returned from Russia, where they have been erecting steel plant, state that nominal wages in Russia are only some 55 per cent. of the German level and that, owing to the high prices—in particular for food and clothing—"real" wages are only some 25 per cent. of those obtaining in Germany. This advantage of low wages is possessed in a greater or smaller measure by all of the minor steel-producing countries.

Russia.

Russia stands first in the countries under discussion both from the point of view of actual output and potential development. The Soviet Government is at present working on a comprehensive development programme covering industry in general and spread over the five years 1928-29 to 1932-33. The iron and steel industry figures in the forefront of this scheme, and a substantial sum is to be invested in the industry, which is planned to have an ultimate productive capacity of 12,000,000 tons of pig-iron and 10,000,000 tons of steel per annum. Such a development would more than double the present output of the industry, but in this connection the Soviet State Bank reports that, whereas for 1929-30 it had been planned to increase industrial output in general by 22 per cent., in effect it was found possible to register an increase of 32 per cent.

The plans for the reorganisation of the iron and steel industry include not only the overhaul, modernisation and extension of existing plant and equipment, but in addition the establishment of completely new units. It is realised that it may be some time before these latter can begin activities, but when they are fully in operation they are expected to produce some 2,600,000 tons of pig-iron and 2,400,000 tons of steel per annum. The areas where the most important developments will take place are the South (Don and Dnieper basins) and the Ural districts. German engineers have recently been erecting steel plants in Russia. American engineers are in Russia at the present time, and a group from the Freyn Engineering Company, Chicago, is concentrating on the investigation of the position with a view to recommending the most economic methods to be adopted in order to put into effect the plans which the Soviet has laid down for its development. These American engineers have emphasised the magnitude of the proposed construction programme, and with regard to the organisation and control of the industry have pointed out that the relative freedom from friction under a system wherein all plants are State-owned and where products and tonnages may be allocated largely at will is exceptional.

Czecho-Slovakia.

Of the three central European countries—Czecho-Slovakia, Austria and Hungary—the former is much the most important. The output of the iron and steel industry in Czecho-Slovakia is well in excess of the absorptive capacity of the domestic market, with the result that export trade is of great importance to the industry. In 1922 a national syndicate was formed to eliminate uneconomic competition and to control sales and prices; practically the whole of the iron and steel industry is now syndicated. Much progress has been made in recent years in modernising plant and equipment, and this syndicate, which has just been renewed for a further period until 1941, has performed useful functions in distributing orders in such a way as to concentrate work in those plants best fitted to carry it out. The Czecho-Slovak industry has concluded an agreement with Austria and Hungary for the mutual protection of home markets and for the allocation of business on the Balkan and Italian markets. In addition, an agreement has been signed with Germany whereby, in return for restricting her sales on the German market, Czecho-Slovakia receives concessions from Germany with regard to deliveries in Italy and the Balkan States.

Austria and Hungary.

As the result of the post-war territorial re-grouping of Central Europe under the Peace Treaties, the iron and steel industry in Austria is sadly deficient in fuel, and in Hungary in ore supplies, the bulk of which in each case has to be imported from other countries. The Alpine Montangesellschaft dominates the metallurgical industry in Austria, being responsible for some 70 to 80 per cent. of the total output of the country. The increased production of iron and steel in Austria during recent years is attributed in the main to the improved demand from the domestic market with which the industry is mainly concerned. It is worthy of note that the Alpine Montangesellschaft has negotiated an Avi agreement, on the German model, with the finishing and working-up industries in Austria, which are thus enabled to obtain their primary iron and steel products, destined to be worked up and exported, at world-market prices. The most important concern in Hungary—the Rima-Murány Company—draws its ore supplies from its own mines situated in Czecho-Slovakia. Although the Hungarian domestic market is important, yet it is not capable of absorbing the whole of the output of the industry and, therefore, a certain amount of attention is paid to export markets, in particular by the Rima-Murány works, which is a member of the Irma (International Railmakers' Association).

The Central European group, joined the Continental Steel Cartel on January 1, 1927, and was allotted a total participation quota of 2,170,000 tons per annum for the first quarter and of 2,290,000 tons per annum for the second quarter of that year. In July, 1928, the Central European group was split up into three separate units, and since that date the Austrian, Czecho-Slovak and Hungarian works have each formed an independent national group within the Cartel. The respective quotas of the different countries were left unchanged. Recently these countries have been demanding higher quotas and, in addition, more-favoured treatment in certain markets in Eastern Europe. It has also been reported that there is a likelihood of the three units once more coalescing into one group so as to formulate a uniform policy in important questions where their interests are identical.

Messrs. P. & W. MacLellan, Limited, Glasgow, have received an order from the Central Argentine Railways for mild-steel plates and mild steel to the value of £8,000.

XUM

Foundry Problems.*

By H. Hurst (Paisley).

In giving this short Paper it was decided to deal with the question of foundry organisation rather than the making of any special castings. In doing so the author has been influenced by the fact that organisations apply to every foundry; the question of a special casting applies only to its own foundry as a general rule.

General Organisation.

In dealing with the general organisation of a foundry one finds several prominent features, viz.:—The type of work; situation of works; hand or machine moulding; foundry personnel; staff and ordinary labour; type and quality of patterns; melting equipment; sand-preparation plant; corestores; and the commercial end of the business.

Taking first the organisation of a foundry, one finds a great variety of methods adopted from the specialised foundry down to the small jobbing shop. In the specialised foundry the latest modern equipment is fitted for all purposes in which the works have been planned to give a certain output of which the bulk of the castings are machine-made. Under these conditions one can organise all the auxiliary plant to these needs with a sand preparation and delivery to its destination, the actual moulds, the transfer by mechanical means to the casting floor, removal of castings to dressing shop and the return of the sand to the preparation floor prior to return to moulding floor. It is possible under these conditions to obtain something of a uniform quality and output. Both the highest quality of patterns and foundry equipment are used here and good results are obtained, and from this one descends by easy stages to the small jobbing foundry, where the plant is of very poor type. An apparently hopeless commercial proposition but for the fact of a very low on-cost and depreciation of plant as compared with the fully-equipped specialised foundry.

One feature stands out here, and it is the necessity of a definite system of planning every operation of every job, so that, on commencing to mould, the method of moulding, making and assembling of cores, size and type of moulding box or machine, in order that the moulder shall have everything to hand for his job of making a mould for a casting. In this manner the work of the shop proceeds in a smooth manner, and at casting time the moulds can be ready at their appointed moment. This being the case, the cupola can be prepared with the requisite metals for different grades of castings with something of a certainty that each casting will get its own metal. The substance of this is that a foundry should have a progress department according to its size, and the expense of this will be small compared to the saving gained by increased production, better castings, and better delivery of the finished product.

Having assumed these details to be correct, one must then consider the type of casting to be made, according to size of casting, its requirements when doing its work and the number of castings required, as these conditions demand their own particular methods of manufacture both for cupola requirements, for qualities of metal, and rate of melting per hr. according to facilities for handling, and more particularly the question of hand or machine moulding. Every casting, where the numbers warrant the expense, should be made either by machine or plate moulding as giving a better casting. In this matter one has to recognise the fact that where a set of castings are made under these methods one gets a minimum amount of irregularities in the shape of the castings, thereby making it a simple matter to use jigs in the machine shop for repetition work and saving of cost in the finished production. This leads to another big factor in the production of a cheap casting, and that is the method of preparing the pattern.

Patternmaking.

Generally speaking, the design is made with a final view to the working of the finished machine. The pattern is often prepared to this drawing, also with a view to making as small expense as possible. It is then handed over to the foundry as an accomplished fact, and a good casting is generally delivered. Here there are three separate departments which are each making a good job of their own work, but often working as separate units, and in cases where different firms are handling the job this can hardly be altered under present conditions. But if one looks closely at this, one finds it a very wasteful method. Just as it is necessary to plan the routine of work in every foundry, so it is far more desirable to plan this at its source, and a far better result would be obtained if this plan were carried through at the beginning by having a system of control where the design could be considered before the pattern is made. By this means many slight alterations could be made, that, whilst they would not affect the design, would often result in a further slight saving on the pattern, and a very large saving on the number of castings required.

Moulding.

The question of machine, plate or hand-moulding would be decided and the pattern made to suit. All questions of loose pieces, coreboxes, manner of moulding and method of casting would be decided and, in my opinion, the creation of such a department would be of such an advantage that its cost would be negligible. It would be possible under such a system to equip a foundry with moulding machines and the work planned with a view of keeping them fully occupied, and this is impossible under other conditions. One must admit in many cases some such system is applied, but one must also realise that in these cases a good result is being obtained. This raises the question of cost of all this extra plant both on a capital account, with its heavy upkeep and allowance for depreciation, or, speaking in general terms, an extra on-cost over the cost of moulding. This is more than compensated for in an increased production, a better type of casting both in regard to quality and finish and a greater use of semi and unskilled labour in the foundry.

The terms "unskilled" and "semi" are rather misleading, for after a short time this labour becomes highly skilled at its own particular job, and so, while it would appear to be lowering the skill required, we should actually be creating another class of labour tending to raise the general tone of the whole work.

These conditions being applied, a considerable saving would be made with a beneficial result both to foundry owners and labour employed in the shape of a reduced cost of casting carrying its ability to give a higher remuneration to all connected with the industry, and, as lower costs bring with it a corresponding increase of orders which may be accepted, this result would be a more uniform flow of work, carrying with it a further reduction of cost and less fluctuation in volume of trade. Looking further, one can visualise the foundry of the future dividing into separate units, of which there would be a section of foundry engineers whose purpose would be the control of the planning operations and plant. The actual moulding and casting, and the mechanical department controlling the melting, drying and raw materials with a central control. The question of training of apprentices has not been dealt with, yet it is a very important matter, and the time will come when there will be day trade schools with a compulsory attendance of all apprentices to receive training in all things connected with their own trade.

The Chairman said that they had got what they expected, a thoroughly practical paper from a practical man, containing much interesting and useful matter. He imagined that there were in the room draughtsmen, engineers, fitters and patternmakers who would be anxious to question Mr. Hurst, so he would not stand between the lecturer and the audience longer.

The Outside Patternmaker.

Mr. J. M. Primrose said that he would leave it to the moulders in the company to discuss moulding problems and methods with Mr. Hurst. In regard to the matter of patterns and patternmaking, and the reference to the desirability of pattern shop and moulding department working together, he thought that that was very largely done, especially where the firm had its own patternmakers. He did not believe that there were many patternmakers who produced patterns not suitable for moulding. The real trouble in his experience was with the firms who supplied nothing but patterns, and the very worst patterns from the moulder's point of view were those supplied by outside shops. They were often solid where they should be loose and loose pieces where the pattern should be solid, and in a large number of cases it paid the foundry to scrap them and make new ones. He thought that if the Institute could do something to get the outside pattern shops into line with those attached to foundries, they would be doing a good service to the trade. He had recently had experience of one of these outside patternmaking firms. Some patterns were supplied which did not commend themselves to him, so he went and interviewed the man who made them, but was told that the patterns were all right. He tried to induce the man who made them to go to foundry and discuss matters with the moulder, but he refused. He discovered that the man who made the patterns had never worked in a foundry. He had been interested in Mr. Hurst's views about moulding by machines. He had recently a motor casting to make for the engineering department of his own firm, and for which he got 26s. per cwt. They eventually lost the work on account of other founders quoting lower price. The price was gradually reduced to 22s. per cwt. after being in three Scottish foundries. He had recently been to a works in the English Midlands, where the castings were now being produced at 12s. 6d. per cwt. One such was being made on a machine with green sand cores (there were 14 cores), and the drawbacks were operated by pulling a lever.

Work Planning and English Competition.

Mr. Hurst, in reply, said that what Mr. Primrose had told them confirmed exactly what he had been trying to impress on them all through the Paper, the fact that the patterns went to England and the castings supplied at half the price of the Scottish foundries, and Mr. Primrose admitted that it paid at 12s. 6d., which showed that the firm visualised the finished castings and planned the process of production stage by stage from the pattern to the dressing shop. As regards patterns, he had worked with them from jobbing shops and from outside. He would much rather deal with patterns made by an outside firm, as if it was not right it could be sent back, but in the case of a patternshop connected with the firm it could not be sent back. The real trouble arose from the want of system, and the fact that the drawing office, patternshop and the foundry all worked independently, each department making a good individual job, but the cost of the finished casting was increased. If the foundry had a proper and efficient planning department it would eliminate the friction be-

* A Paper read before the Scottish Branch of the Institute of British Foundrymen, Mr. H. Winterton presiding.

tween the departments. The central control would take charge right through and say how the pattern and moulds were to be made. Economies would result, as the co-ordinated control would cut out much wastage.

A Striking Admission.

Mr. J. M. Primrose said that the point he wanted to make was that most jobbing jobs were really repetition jobs, and could be made in a much cheaper way than is usually done.

Mr. Laurie said that he was not a repetition casting expert but a jobbing foundryman. At the recent visit to the Argus foundry he saw work which was not really repetition work being done by repetition methods, which had been evolved as a result of very careful planning such as Mr. Hurst had advocated. He thought that many of the foundries in Scotland required revolutionising, and what Mr. Primrose had said about the pattern which went to England because the castings could be made at half the price showed that Scottish foundries were behind. One of the difficulties of the jobbing founder was that if he got a pattern he never knew whether he would ever see it again because someone would cut the price.

Quoting from Unseen Patterns.

Another difficulty was that the jobbing foundry was asked to quote the price of a casting, and he had to visualise the job as best he could because he never knew what sort of a pattern he was going to get. He had had patterns which could only be described as bunches of wood. The pattern shop was a big problem, as the patternmaker took no responsibility for the foundry end of the job. What it cost the foundry to produce castings from his patterns was no concern of the patternmaker. He would always prefer to work from his own patterns, as they could be prepared to suit his moulding methods and also usually at a lower price than the outside firm.

Repetition Jobs Demand Planning Department.

Mr. N. McManus said that he would like to justify practically everything that Mr. Hurst had said in regard to the necessity of planning the work. On repetition work it was impossible to be successful unless very careful consideration was given to all stages of the process. In respect to patterns his experience was that if the design of a casting was unsuitable for the foundry a representation to the drawing office resulted in suitable alterations being made in nine cases out of ten. Although he confirmed all that Mr. Hurst said about organisation and machine work, he wished to warn them that it was not all plain sailing; repetition machine working had a technique all of its own, and there were many pitfalls.

Mr. Hurst replied that he thanked Mr. McManus for his remarks, and that the visit to Argus foundry the previous week had confirmed the views he held regarding the planning department. He realised that there were many pitfalls, and it was for that reason that he had stressed the point that the more jobs put on to repetition work the more necessary it was to have an efficient planning control and supervision system.

English Competition.

Mr. J. Longden said that he had been very much interested in the remarks of Mr. Primrose in regard to the casting which cost 26s. per cwt. in Scottish foundries being made in England at 12s. 6d. per cwt. at a profit. He thought that there must be something which Mr. Primrose had not told them about the job. It would depend upon how many castings the foundry had in sight as to whether it would pay to make a pattern to mount on the machine. If a large number would be required then one could make a pattern to suit. He would like to know whether the Scottish foundry had the same facilities as the English foundry. The difference in price demanded much explaining. Mr. Hurst had covered a considerable amount of ground, and with most of his views he could agree, but he thought that Mr. Hurst had rather tended to overstress the idea of taking an unskilled man off the street to work moulding machines and to make him a skilled operator in two or three days. He did not agree with that, it simply could not be done. Many machines were quite complex, and the working of them was complicated work. If the man had not already the skill he had to acquire it, and that took time.

Foundry Manager the Planning Department.

As regards Mr. Hurst's advocacy of a planning department, it would depend on the size of the foundry whether it was worth while or whether it would pay. What really mattered was that every department should be consulted—draughtsman, patternmaker and moulder. He said emphatically that no one was capable of planning the production of the castings except the foundryman. It was useless talking about foundry planning unless one had a man who understands it. He thought that to talk about the foundry having a planning department was beside the mark, the only planning department should be the foundry manager himself.

Mr. Hurst, in reply to Mr. Longden, said that with regard to putting a man on a machine and making him a skilled operator in two or three days, there were some machines that he could put anyone on, even a girl, such, for instance, as small Pridmore machines, and in a day or two have them quite skilled. He did not say any such thing in regard to larger and complicated machines; in fact, he thought it would be madness to attempt it. Mr. Longden had seemed to disagree with the idea of a planning department, but perhaps he had not quite understood the idea. He wished to say once and for all that he did not want anyone to come along and stick up a label planning department. Every foundry manager was his own planning department. Perhaps he would be better to speak of a planning system to explain his idea.

Cheap Patterns.

Mr. James Miller (President-Elect) said he was in agreement with what had been said about the patterns from outside sources; such firms are, as a rule, only there to make a cheap and not necessarily a workable pattern. Personally he always preferred the patterns made in his own place. He was rather favourably placed, as the pattern shop was under his own jurisdiction. It was his practice when the blue print was sent to the foundry to go over it with the foreman, and in the event of there being something unsuitable or something that could be altered to facilitate moulding, he made application to the drawing office, which invariably acquiesced.

The President, in proposing a vote of thanks to the author, said that he was sure that all had appreciated the manner in which Mr. Hurst had stated the case for a subject upon which he had evidently spent a great deal of thought.

Contracts Open.

Antwerp.—Boiler and radiators, for the Antwerp Municipal Authorities. The Department of Overseas Trade. (Reference B.X. 6,311.)

Cairo, July 15.—15 complete pumping stations, for the Egyptian Ministry of Public Works, Mechanical and Electrical Department. The Department of Overseas Trade. (Reference A.X. 9,437.)

Melbourne, April 28.—Two centrifugal-type pumps, for the State Electricity Commission of Victoria. The Department of Overseas Trade. (Reference A.X. 9,445.)

Wellington, N.Z., July 16.—Two travelling jib cranes, for the New Zealand Government Railways. The Department of Overseas Trade. (Reference A.X. 9,442.)

Method for Determining Iron Oxide in Liquid Steel.

At the present time there are two generally accepted methods of determining iron oxide or oxygen in steel. The first, and older, is reduction of the sample with hydrogen, the water vapour formed being weighed and calculated back as per cent. oxygen in the steel. This was first devised by Ledebur some 50 years ago, and held the attention of chemists and metallurgists during that period. The vacuum-fusion method for determining oxygen in steel has been in vogue for the past few years. Both these methods deal with the oxygen content of solid steel and are applicable to steels in the cast or rolled conditions, but not necessarily to steels in the liquid state, since oxygen in the form of carbon monoxide or carbon dioxide is lost during solidification of the test-piece or ingot.

The Metallurgical Section of the Pittsburgh Experiment Station of the United States Bureau of Mines, Department of Commerce, in co-operation with Carnegie Institute of Technology and the Metallurgical Advisory Board, has devised a method for the determination of ferrous oxide in liquid steel. This consists, briefly, in killing a sample of liquid steel with an excess of aluminium and determining the alumina formed. The killing of the sample is done with heavy aluminium wire in the test spoon and not in the test mould. If the sample is killed in the test mould, oxygen may be lost at the first moment of solidification or the aluminium may segregate very badly in the test-piece. On the other hand, when the aluminium is added to the liquid steel in the test spoon, fairly uniform distribution of alumina in the test-piece is assured.

A 1-per-cent. aluminium addition has been found to give satisfactory results in the determination of the oxygen present. The manipulation is very simple, the aluminium being added to the test spoon as soon as the sample is withdrawn from the furnace and the metal then immediately poured into the test mould. The solid sample is drilled and 20 grammes of drillings taken for analysis. The analysis consists of solution of the drillings in 20-per-cent. hydrochloric-acid solution followed by filtration of the residue, washing with hot 1 : 1 hydrochloric acid, ignition and treatment with hydrofluoric acid to remove any silica present. The weighed residue is calculated from alumina to ferrous oxide from the oxygen equivalent of the two.

The chief advantage of this method is that it determines the total oxygen in the liquid state and not in the solid state, and that it avoids the loss of oxygen during solidification of the test-piece. The method should be of considerable value in determining the oxygen content of both open-hearth and Bessemer steels before any deoxidiser is added to the furnace or ladle. If deoxidisers have been added, the method may give erroneous results in that the aluminium will reduce manganous oxide and some silica. It is, therefore, best to use this method on steel before deoxidation, and to use either the hydrogen reduction or the vacuum fusion methods for steels after deoxidation.

Famous Shipyard Entertains Foundrymen.

(*Continued from page* 309.)

ago had built the Cunard liner "Mauretania." Their thanks were also due to the officials who had shown them round the works. Mr. Shaw seconded this motion, and a hearty vote of thanks was passed unanimously.

Mr. Taylor, works manager, replied on behalf of the company and staff. In going round the works they might not have seen anything of outstanding interest, but they would have obtained some idea of the multiplicity of the work which was done, and he hoped that they would have learnt something new and benefited by the visit.

South African Iron and Steel Industry.*

PRESENT POSITION AND PROSPECTS.

By T. Nimmo Dewar.†

The existing concerns producing iron and steel goods in the South African Union are as follow: (*a*) The Union Steel Corporation (of South Africa), Limited, with works situated at Newcastle, Natal, and at Vereeniging in the Transvaal; (*b*) the Dunswart Iron & Steel Works, Limited, situated at Benoni; (*c*) George Stott & Company, Johannesburg; and (*d*) the Witwatersrand Co-operative Smelting Works, Johannesburg.

The Union Steel Corporation (of S.A.), Limited.

The Union Steel Corporation (of S.A.), Limited, was formed in 1912 by the late Senator Samuel Marks and the late Mr. Isaac Lewis, to carry out a contract with the Government for the purchase of about 15,000 tons of railway scrap, mainly available at Pretoria, together with further regular deliveries of iron scrapped in the Transvaal and a large portion of the country, at the exceptionally low price of £1 per ton. The contract was for a period of sixteen years, and stipulated that three years after the works had commenced to produce, experiments in smelting local ores were to be undertaken when the Corporation earned surplus profits after paying a dividend of 7 per cent. on its capital. Under this contract the Railway Administration agreed to purchase its entire requirements in material from the Union Steel Corporation—as far as the latter company could produce same—provided that the prices were not higher than those of foreign competitors. The share capital of the Union Steel Corporation, Limited, on its formation was £25,000, but this has been increased on several occasions, until to-day the issued capital stands at approximately £1,187,000, including debentures.

The works are situated on the banks of the Vaal River, at Vereeniging, approximately 38 miles from Johannesburg. The construction of the works was commenced in the year 1912, and production started in August, 1913. Between that date and September 30, 1914, the production of ingots totalled 2,141 tons. In subsequent years, production rapidly increased, and ten years later amounted to over 20,000 tons per annum, while the actual output for the year 1928 was 27,877 tons of ingots. The total production of ingots since the commencement of operations in 1913 to December 31, 1928, was 242,363 tons.

The works are most favourably situated from the point of view of power, coal and water supplies. Coal is obtained locally from the collieries of the Vereeniging Estates, Limited. The melting shop consists of three basic-lined Siemens-Martin open-hearth furnaces, with normal capacities of 23, 30 and 35 short tons (2,000 lbs.) respectively, together with one electric basic-lined furnace of the "Héroult" type, having a normal capacity of 3.75 long tons. When working at full capacity, the furnaces are easily capable of producing 60,000 short tons of ingots per annum.

Prior to the start up of the blast furnace at Newcastle, in June, 1926, the entire output of these works was produced from worked-up scrap iron. As soon as pig-iron became available the charging base was altered to include 50 per cent. of miscellaneous scrap and 50 per cent. of pig-iron. The electric furnace is employed for the production of special steel ingots, shoes and dies, and steel castings, the output varying from 300 to 450 tons per month.

The Union Steel Corporation has recently added to its activities the production of galvanised and barbed wire. The wire works are situated on the outskirts of the Vereeniging township, and have been erected at a cost of £160,000. The buildings are designed to accommodate machinery for the production of 20,000 tons of wire rods, 20,000 tons of bright wire, or 20,000 tons of galvanised wire per year. The machinery actually installed is capable of producing 20,000 tons of wire rods, 10,000 tons of bright wire, and 5,000 tons of galvanised wire per annum. The billets required for the production of these goods are turned out in the central works.

The sections undertaken at these works comprise: Tube-mill bars, grizzly bars, rails; fish-plates to suit all sections of rails; flats, rounds and squares; angles, tees and channels; steel castings up to 10-tons each. Billets are now being produced for the requirements of the tube works situated at Vereeniging and owned by Messrs. Stewarts & Lloyds, of South Africa, Limited.

The variety of sections produced by these works in order to meet the local market amounts to slightly more than 300 in number, and if the various grades of steel are taken into account, a further 800 qualities and sections must at least be provided for. It is doubtful if any other works throughout the world are obliged to cope with such a variety of finished products.

The Dunswart Iron and Steel Works, Limited.

In the year 1911 Messrs. Cartwright & Eaton founded a wrought-iron rolling works at Dunswart, near Benoni, the name of the company being "The Union Iron and Steel Works." In 1914 the name of the company was changed to the "Dunswart Iron & Steel Company, Limited," under the same directors, the share capital being increased to £25,000. During subsequent years the capital was gradually increased to meet the expansion of business, and now stands at £145,000 issued, of which £25,000 carries a preference dividend of 7½ per cent.

The equipment of these works consists of the following:—Puddling furnace; five ball furnaces; 12-in. three-high mill; 8-in. three-high mill; a shingling hammer; two 7-ton electric furnaces, of the "Héroult" type; an 18-in. bar mill—electrically driven. These works possess the only puddling furnace in South Africa, from which is produced high-grade bar-iron, comparable with Yorkshire best.

The products of these works comprise:—Small quantities of puddled iron; mild-steel rounds up to 2½ in., squares up to 2 in., flats up to 4 in. by 1 in.; angle iron up to 3 by 3 by ½ in.; steel castings up to 12 tons. A special hollow drill steel for use at the mines is also made successfully.

The Dunswart works use only scrap as a base, and are not equipped for the use of pig-iron. The output at present is in the order of 800 tons per month.

Geo. Stott & Company, Limited.

The works of this company are situated in Johannesburg, and consist of six small steel furnaces and one rolling mill, the capacity of the plant being about 500 tons per month, working double shift. The furnaces are equipped for the use of scrap iron only, although a number of billets are purchased from the Union Steel Corporation, which after reheating are rolled down to the smaller sizes.

The products of these works are:—Mild-steel rounds up to 2 in. dia.; flats up to 4½ in. by 1 in.; squares up to 2 in. The furnace and rolling-mill plant was started up about eight years ago, and the actual output at the present time averages about 400 tons per month. The capital of the company is £20,000, of which £16,000 is issued.

The Witwatersrand Co-operative Smelting Works, Limited.

The steel works of this Company are situated at Driehoek, about eight miles from Johannesburg, and principally consist of:—A "Héroult" electric furnace of 2 tons capacity; 3 Kjellin electro-steel furnaces of 1 ton each; a preheating furnace.

The capacity of the works is of the order of 400 tons per month, and operations are confined to the production of shoes and dies for the mill stamps. Each charge consists of 35 per cent. scrap of shoes and dies and 65 per cent. sorting (rails, wire, etc.). The scrap is obtained from the mines, and costs about £3 per ton. The present output of these works is about 400 tons per month. The issued capital of the company is £73,800.

Total Production of Iron and Steel in South Africa.

The total capacity of the four works now engaged in the production of iron and steel goods does not exceed probably 80,000 tons per annum, including steel castings. The actual output from the entire iron and steel industry of the Union for the year 1928 was approximately 45,000 tons, covering rolling-mill products and castings. This figure does not include the production of pig-iron.

* From a Paper presented to the Third (Triennial) Empire Mining and Metallurgical Congress, South Africa, 1920.

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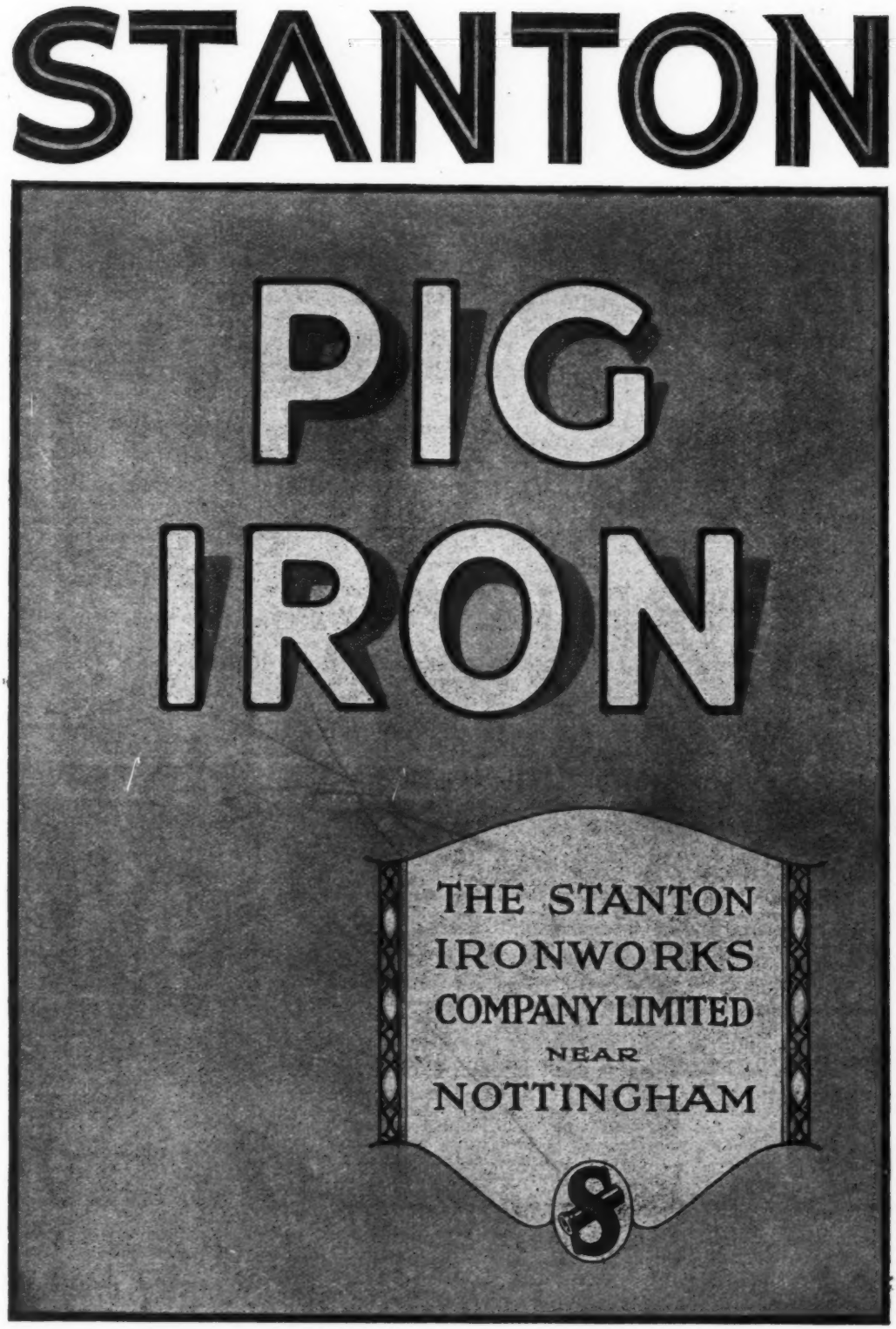
The Continental Steel Cartel.

Last week the general committee of the distribution syndicates under the Continental Steel Cartel met in Brussels. Among the questions under consideration were complaints received that members of the Cartel had violated the agreement in regard both to their production and the minimum basis prices. It is said to have been ascertained at the meeting that the breaches of the agreement were not so serious as certain parties described them, and that the functioning of the present organisations is quite satisfactory.

With regard to the alleged hunt for orders, it was emphasised that every member and every participating country having a fixed quota has no interest in dealing at prices lower than those established by the distribution organisations. It is understood that the present basis prices will remain without change for the present.

The Continental Steel Cartel has also considered the question of the organisation of a comptoir for hoops. Prices and selling conditions were settled, at least theoretically, as no producer has so far bound himself to adhere to them. The questions of export quota and of inland comptoirs in Belgium and France are still unsettled.

American Specification for Cast Iron.—A meeting of Committee A-3 on cast iron was held in conjunction with the Spring group meeting of the American Society for Testing Materials committees in Detroit on March 20. The Sub-Committee on high-test cast iron reported that specifications for several classes of cast iron of higher strength were under consideration. The Sub-Committee on correlation of test bar and casting has continued its investigations on a number of forms of test bars in sizes ⅛, ¼, ½, ¾, 1 and 1¼ in. thick, all cast in one mould and on rectangular castings having four sides with different thicknesses, namely, ½, 1, 2 and 3 in. respectively. There was much discussion as to the value of the present arbitration test bar, and the Sub-Committee plans to carry on investigations of three bars now used as standard in the British Empire and also on bars ¾, 1.2 and 2 in. dia. respectively, the ¾ in. bar to be tested transversely on a 12-in. span, the 1.2-in. bar on an 18-in. span, and the 2-in. bar on a 24-in. span. The Sub-Committee on impact testing, continuing its investigations during the coming year, will also make transverse, tension, fatigue and compression tests on cast iron in addition to the impact determinations in order to determine the relative value of the various tests.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Trade Talk.

Mr. W. D. Scrimgeour has relinquished his position as accountant of the United Steel Companies, Limited, and has commenced practice in partnership with Mr. E. M. Scrimgeour at 20, Bucklersbury, London, E.C.4, under the style of W. D. Scrimgeour & Company, chartered accountants.

The Ford Motor Company, of Dearborn, Michigan, U.S.A., is said to have concluded an agreement with the Government of Turkey for the establishment of new plant at Constantinople to manufacture Fordson tractors. This, including parts and assembling departments, will cost over £100,000 with equipment.

The "Sentinel" Waggon Works, Limited, of Shrewsbury, have built a new London service depôt at North Acton. The old depôt in Fernhead Road, Paddington, was closed on Thursday, April 17, and business was resumed on Wednesday, April 23, at the new depôt, which is situated in Minerva Road, on the Chase Estate, Acton, N.W.10.

The engineering trade unions have received a reply from the Prime Minister to their request that an inquiry should be set up by the Government into the engineering industry. Mr. MacDonald has not accepted the proposal. The unions asked for an inquiry comparable in scope with those now being conducted into the iron and steel and cotton industries.

The Hunslet Engine Company, Limited, Leeds, have received a contract for eight tank locomotives for the Gold Coast Railways, to the order and inspection of the Crown Agents for the Colonies. These are a modified design of one of the Hunslet Company's standard engines of the eight-wheeled coupled type, and are required for the transport of manganese ore at Takoradi. The cylinders are 18 in. dia. by 23 in. stroke.

Messrs. T. W. Ward, Limited, of Sheffield, announce that they have decided to dismantle the Denby blast furnaces, near Derby, which they recently acquired from the Denby Iron & Coal Company, Limited. The work of demolition will begin at once. Each of the four furnaces had a capacity of 350 tons per week. The Denby Company was formed in 1890 with a capital of £30,000, which was afterwards increased to £100,000.

The Central Electricity Board have placed contracts with the Enfield Cable Works, Limited, for certain overhead transmission lines in connection with the North-West England and North Wales Electricity Scheme, 1928, and with Watsham's, Limited, London, and Messrs. W. T. Henley's Telegraph Works Company, Limited, for overhead transmission lines in connection with the South-East England Electricity Scheme, 1927. The total value of the contracts is about £320,000.

The directors of the Duffield Iron Corporation, Limited, in a circular to shareholders, state that in December last they completed the running-in of the auxiliary plant, and the tests were satisfactory. Since that date they have been engaged in testing the electrical equipment and crushing, mixing and measuring plant under load conditions. During these operations they have been delayed by having to carry out minor adjustments. These are being gradually completed, and it is hoped that the testing of the retort furnace under firing conditions will shortly take place.

On April 11, 1930, Mr. Frank Russell, F.G.S., chairman and managing director of Messrs. General Refractories, Limited, of Sheffield, gave a lecture to the Sheffield Section of the Institute of Metals in the Non-Ferrous Lecture Room at the Applied Science Department, St. George's Square, Sheffield, on "Refractories and Their Uses." The lecturer amplified his remarks with a number of interesting specimens, and dealt with the growth and expansion of the refractories industry throughout the ages. Mr. Russell explained how, by research and experimental work, refractories were in a position to supply industry with bricks which would last very many times as long as materials previously used. He showed specimens of some of the very latest types of refractories, and the meeting closed with a vote of thanks to Mr. Russell for his excellent talk. Mr. F. C. Robinson presided.

It is officially announced that the board of directors of the National Shipbuilders Security, Limited, will be composed of the following:—Sir James Lithgow (chairman), chairman of Messrs. Lithgows, Limited, Port Glasgow, Messrs. William Hamilton & Company (1928), Limited, Port Glasgow, and Messrs. R. Duncan & Company, Limited, Port Glasgow; Mr. A. L. Ayre, chairman and joint managing director of the Burntisland Shipbuilding Company, Limited, Burntisland; Mr. John Barr, formerly commercial manager and special director of Messrs. Vickers, Limited, at Barrow; Commander Craven, R.N., director of Messrs. Vickers-Armstrongs and Messrs. Vickers, Limited, in charge of Vickers-Armstrongs shipyards at Barrow and Newcastle; Mr. J. W. Kempster, director of Messrs. Harland & Wolff, Limited, London; Sir Alexander M. Kennedy, chairman and managing director, Fairfield Shipbuilding & Engineering Company, Limited, Glasgow, chairman, Messrs. William Doxford & Sons, Limited, Sunderland, and chairman and managing director, Northumberland Shipbuilding Company (1927), Limited, Howdon-on-Tyne; Mr. F. C. Pyman, managing director, Messrs. William Gray & Company, Limited, West Hartlepool; Mr. A. M. Stephen, director, Messrs. Alexander Stephen & Sons, Limited, Glasgow; Mr. T. E. Thirlaway, chairman, Messrs. Swan, Hunter & Wigham Richardson, Limited, Wallsend, and Messrs. Barclay, Curle & Company, Limited, Glasgow; and Mr. R. Norman Thompson, director, Messrs. J. L. Thompson & Sons, Limited, Sunderland, and Messrs. Sir James Laing & Sons, Limited, Sunderland. When the National Shipbuilders Security, Limited, was registered at the end of February, with a capital of £10,000 and borrowing powers up to £3,000,000, it was explained that the company was a collective scheme within the industry itself, by which it was hoped to eliminate redundant shipyard capacity and secure more economical costs by the resultant concentration of production.

New Companies.

Allan Ure & Company, Limited, Springbank Foundry, Kippochhill Road, Glasgow.—Capital £15,000. Ironfounders, etc. Directors: A. M. Ure and A. F. Ure.

Parson, Limited.—Capital £20,000. Iron and steel merchants, etc. Permanent directors: C. A. Parson (chairman), 114, Bedford Court Mansions, London, W.C.; and C. C. Parson.

Marshall Osborne & Company, Limited, Aston Brook Street, Birmingham.—Capital £10,000. Machinists, founders and casters, etc. Directors: M. Osborne and H. R. Willday.

Demellweek & Redding, Limited.—Capital £1,000. Iron and steel merchants, etc. Directors: G. A. Ryland, "Hill Crest" Colley Gate, Cradley, Worcestershire; and F. Redding.

Johnsteads Engineering Company, Limited, 52, Strode Road, Willesden Green, London, N.W.—Capital £2,500. Directors: J. D. Barnard, E. W. Barnard, J. W., E. E. and R. V. Petzing.

Lewis J. Akroyd, Limited, West Ward Ironworks, Hanson Lane, Halifax.—Capital £7,000. Machinery and metal brokers and merchants, etc. Directors: L. J. Akroyd, J. B. Houseman and T. Akroyd.

Headly & Edwards (Cambridge), Limited, 11 and 12, Corn Exchange Street, Cambridge.—Capital £10,000. Ironfounders, etc. Directors: O. Webb, P. B. Grain, G. F. Dale, F. Carr and E. C. Pointer.

Sir W. G. Armstrong, Whitworth (Ironfounders), Limited.—Capital £130,000 in £1 shares, to acquire from Armstrong Whitworth Securities, Limited, the business of ironfounders carried on at the Close Works, Gateshead, and to carry on the business of boiler-makers, ironmasters, colliery proprietors and manufacturers of rolling-stock, with power also to undertake the business of a wagon finance company. Solicitors: Roney & Company, 42, New Broad Street, London, E.C.2.

Streetley Lime & Basic Company, Limited, Shireoaks, Worksop, Notts.—Capital £360,000 in £1 shares (175,000 preference and 185,000 ordinary), to acquire and amalgamate the businesses carried on by the Streetley Lime Company, Limited, the Yorkshire Basic Company, Limited, the Taffs Well Dolomite Company, Limited, the Porthywaen Lime Company, Limited, the Whitehaven Basic Company, Limited, and the Llynclys Lime Works, Limited, and to carry on the business of cement manufacturers. Directors: E. J. Noble, E. D. Nicholson, A. O. Peech, G. Hatton, C. B. Gardner, C. P. Blatchley and W. Plant.

Company Meetings.

Sir William Arrol & Company, Limited.—The annual meeting of Messrs. Sir William Arrol & Company, Limited, was held in Glasgow. Sir John Hunter, who presided, said that inquiries for work of any size were not numerous, and there was still very keen competition for all that was going. They were fortunate in having a substantial amount of work in hand. Satisfactory progress was being made with the bridge over the River Benue in Nigeria. Their crane works were fairly well employed, but during the past year competition had been keener than ever, and at the moment inquiries for cranes were scarce. There did not seem to be much sign yet of the long-expected revival in the trade of this country.

Swan, Hunter & Wigham Richardson, Limited.—Presiding at the annual meeting of Messrs. Swan, Hunter & Wigham Richardson, Limited, held recently at Newcastle-upon-Tyne, Mr. T. E. Thirlaway (chairman) discussed the present position of the company and the future of shipbuilding. He said that the various departments had a considerable amount of work to go on with, but additional orders would have to be obtained if they were to keep up the continuity of work. Therein lay the uncertainty of the future. Inquiries for special types of vessels would no doubt come along, but for ordinary cargo vessels inquiries were practically non-existent, due to the low freights prevailing and to the number of vessels at present laid up. The position of shipbuilding and engineering in the country had not shown much, if any, solid improvement during the past year, nor were there any visible signs of any such improvement taking place in the near future. There were many causes contributing to this state of affairs—curtailment of warship building, the excess of tonnage over the world's requirements, and the fact that the capacity of both shipyards and marine engineering works was far in excess of any possible requirements, making competition more keen for the limited amount of work that was offering. Speaking of rationalisation, Mr. Thirlaway said that so far as shipbuilding was concerned, something had already been accomplished in that direction, but more remained to be done. While other countries had been successfully engaged in applying the principle of rationalisation to their principal industries, we in this country had been advancing but haltingly in that direction.

Personal.

Mr. Paul D. Merica, research director of the International Nickel Company, New York, U.S.A., is now spending several weeks in Europe.

Mr. Henry Ashman Reed has retired from the position of chief engineer to the Manchester Ship Canal Company. He will be succeeded by Mr. F. B. Greenwood, assistant engineer.

Mr. H. C. Else (chairman and managing director), Mr. S. C. Else and Mr. L. H. Else have resigned from the board of Messrs. William Cooke & Company, Limited, Tinsley, Sheffield.

Mr. W. Main, of Messrs. T. Main & Sons, ironfounders, Melbourne, Australia, has arrived in England from America. He proposes making an extensive tour of Great Britain, visiting the more important foundries in the Birmingham, Manchester, Glasgow, Newcastle, East Midlands and London districts. Correspondence for Mr. Main can be addressed, care of the editorial department, at these offices.

Wills.

Dove, Major George, managing director of the Redbourne Hill Iron & Coal Company, Frodingham £20,398

Swinton, A. A. C., a director of Messrs. Crompton, Parkinson, Limited, the Parsons Marine Steam Turbine Company, Limited, and of many electrical supply companies £99,785

Reports and Dividends.

Babcock & Wilcox, Limited.—Final dividend on the ordinary shares of 8 per cent., making 15 per cent., tax free, for the year.

Haslam & Newton, Limited.—The directors have decided to postpone payment of the half-yearly dividend on the cumulative preference shares, due on May 1.

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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—In accordance with custom, the current week is generally observed as a holiday throughout the North of England industrial centres, and on this occasion at all events it will cause little interruption, as far as actual business is concerned, in the weekly markets for Cleveland iron, which are invariably idle during Easter-tide. With regard to the future prospects of increased trade in the near future, however, following the recent Budget disclosures, market opinion is practically unanimous in adverse criticism of the ultimate result of the Chancellor's proposals of still heavier burdens of taxation in further restricting industrial enterprise by impairing its competitive power in meeting foreign competition. The postponement of the abolition of the McKenna duties is, perhaps, the one bright feature of Mr. Snowden's pronouncement of his Budget proposals. In this direction the springs of industry have been released, confidence is restored, and the promised offensive on the world's markets will immediately produce welcome orders for iron and steel. In the meantime stocks in makers' hands are accumulating, and an opportunity to liquidate these would be welcome. Unfortunately, foreign competition in the Scottish area is still keen, and though inquiries from abroad are more numerous, hopes of an expansion in the export trade have not yet been realised. Prices, of course, are unchanged, makers' minimum figures, both for home deliveries and for export, being:—No. 1 Cleveland foundry iron, 70s.; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; No. 4 forge, 66s.

In the market for East-Coast hematite business also is temporarily at a standstill, with prices lower at 74s 6d. per ton for mixed numbers. On the North-West Coast, Bessemer mixed numbers are quoted at 76s. per ton at works.

LANCASHIRE.—Only a quiet demand for foundry pig is in evidence in the local markets, and few orders of importance have been reported of late, consumers confining commitments within the narrowest possible limits pending a decision on the question of prices at the forthcoming meeting of producers. With regard to prices, for delivery to local consumers Derbyshire and Staffordshire No. 3 qualities are quoted at 77s. per ton, with Scottish makes at 95s.

THE MIDLANDS.—Conditions in the Birmingham market for foundry pig continue dull, and there have been very few orders placed during the week. Consumers are not prepared at this juncture to commit themselves for forward supplies, as they are confident that the present prices cannot hold. Meanwhile the rates are:—75s. for Northants No. 3, and 78s. 6d. for Derbyshire and North Staffordshire No. 3, delivered local stations.

SCOTLAND.—The pig-iron market in this area shows no improvement, and, as far as Scotch pig-iron is concerned, buyers continue their policy of buying from hand to mouth, hoping for a reduction in prices. The makers, however, maintain their quotation at 78s. per ton f.o.t. furnaces for No. 3 foundry. Some of the founders are going over to Indian foundry iron, where they can, as it is being sold at slightly under the Scotch price, but in this case they have to take the iron when it is available, which is not always convenient.

Finished Iron.

At Birmingham this week little business has been transacted in this section of the market; nor has the position improved to any appreciable extent. The demand for marked bars keeps up to a fairly satisfactory level at the price of £12 10s. at works. The market is quiet in the extreme for crown and the cheaper grades of iron. The former is quoted at £10 5s. to £10 7s. 6d. delivered this area, but crown bars are obtainable in other directions at as low as £10. The local price for nut and bolt iron is £9 to £9 7s. 6d., while Belgian No. 3 iron is being offered delivered this district at between £6 1s. and £6 3s.

Steel.

In the markets for steel and finished products generally, inquiry has been irregular, but there is a growing belief that stocks in most of the important markets have reached an unusually low level, and that some improvement in export buying may be expected. The demand for semi-finished material has shown some improvement, and the British works have taken a fair share of the business. At Sheffield the recent improvement in the call for acid billets is hardly maintained. The falling-away in basic billets is considered to be merely temporary. Wire rods are having to meet heavier competition from the Continent. Production of open-hearth steel in this district is being cut down in view of the smaller demand, but manufacturers of special and stainless steel are busy. In the tinplate market quotations for coke quality remain firm at 18s. 3d. to 18s. 6d., net cash, f.o.b. Welsh ports.

Scrap.

Markets for foundry scrap material continue quiet, with few changes in prices recorded during the current week. On the North-East Coast the foundries are slack and are taking only very small quantities of heavy cast iron, but prices are unchanged, with ordinary quality at 61s. and good machinery quality in handy sizes at 64s. per ton. In the Midlands prices of cast-iron scrap show signs of weakening. Machinery cast-iron scrap in handy sizes is offered at 66s. to 67s. per ton, ordinary heavy metal at 63s. 6d. and light at 55s. In Scotland heavy machinery cast-iron scrap is unchanged at 68s. 6d.; heavy ordinary cast iron, suitable for foundries, 63s. to 64s.; railway chairs, 66s. 6d.; light metal, 58s. 6d. to 59s. 6d.; and old cast-iron firebars, 56s. to 57s., these prices being per ton delivered f.o.t. consumers' works.

Metals.

Copper.—The outstanding event in last week's markets for base metals was the announcement of the long-expected break in the "pegged" price of electrolytic copper by the American combine from 18 cents to 14 cents per pound, equal to a cut of £20 per ton. The immediate effect was a relapse of quotations on the standard market some £5 per ton, with every prospect of still further declines in the near future.

Closing quotations:—

Cash.—Thursday, £58 17s. 6d. to £59; Tuesday, £55 7s. 6d. to £55 12s. 6d.; Wednesday, £54 5s. to £54 7s. 6d.

Three Months.—Thursday, £58 16s. 3d. to £58 18s. 9d.; Tuesday, £55 to £55 5s.; Wednesday, £54 5s. to £54 7s. 6d.

Tin.—Interest in this section of the market has been chiefly centred in the progress of the Tin Producers' Association towards a solution of the problem of the restriction of outputs of the metal at the source. The latest development to date has been a general meeting of members of the Association, held in London on Wednesday last week, when a formula of tin production control suitable for all mining conditions was submitted. The formula, it is stated, will increase by approximately 3,751 tons the curtailment now in force for 1930, making the aggregate curtailment more than 30,000 tons.

Official closing prices:—

Cash.—Thursday, £165 to £165 2s. 6d.; Tuesday, £162 2s. 6d. to £162 5s.; Wednesday, £160 12s. 6d. to £160 17s. 6d.

Three Months.—Thursday, £167 5s. to £167 7s. 6d.; Tuesday, £164 10s. to £164 12s. 6d.; Wednesday, £162 17s. 6d. to £163.

Spelter.—Practically no interest was taken in the market by consumers and dealers during the past week, a fact for which the holiday was no doubt partly accountable.

Daily quotations:—

Ordinary.—Thursday, £17 16s. 3d.; Tuesday, £17 10s.; Wednesday, £17 6s. 3d.

Lead.—The undertone of the lead market is firm, and very little change was noticeable during the week.

The week's prices have been:—

Soft Foreign (Prompt).—Thursday, £18 6s. 3d.; Tuesday, £18 1s. 3d.; Wednesday, £17 15s.

Financial Aid for Basic Industries.

The Lord Privy Seal (Mr. J. H. Thomas) announced in the House of Commons recently the registration of the Bankers' Industrial Development Company, Limited, under the chairmanship of Mr. Montagu Norman, designed to receive schemes for rationalisation put forward by basic industries and to provide the money necessary to carry them out. The company will be assisted by an advisory committee, with no specific duties, but so composed as to act as a panel of assessors on the schemes submitted. Mr. Thomas added that the operations of the company would involve no State guarantee or investment, and no veto upon rationalisation schemes other than those submitted to it.

The nominal capital of the company is £6,000,000, divided into 45 "A" shares and 15 "B" shares of £100,000 each. Mr. Thomas stated that the company is supported by a very considerable proportion of the most influential banking and financial institutions of the country, by which the "A" shares have been subscribed. The "B" shares have been subscribed by the Securities Management Trust, Limited. The directorate of the new company, which is honorary, is as follows:—Mr. Montagu Norman (chairman); Sir Guy Granet, who will also be alternate to Mr. Norman; Baron Bruno Schröder (with Major A. Pam as alternate); Mr. A. R. Wagg (with Mr. Nigel Campbell as alternate); Mr. E. R. Peacock; and Mr. C. Bruce Gardner, managing director of the Securities Management Trust.

Catalogue Received.

"A Short History of General Refractories, Limited, with details of its Personnel, Aims and Activities; its Products, Properties and Resources," is the title of an admirable brochure prepared by the company indicated. The booklet, which contains 28 well-illustrated pages, has covered concisely and intelligently the objects set out in its title. It constitutes an enterprise well worth emulation by other concerns which conduct a nation-wide business. It makes the executive officers feel that they are important and trustworthy members of a company, and gives to the customers knowledge of the status and type of experience possessed by each person with whom they make contact. The general get-up of the book is excellent, except the choice of type, which is more difficult to read than the founts normally used for such work.

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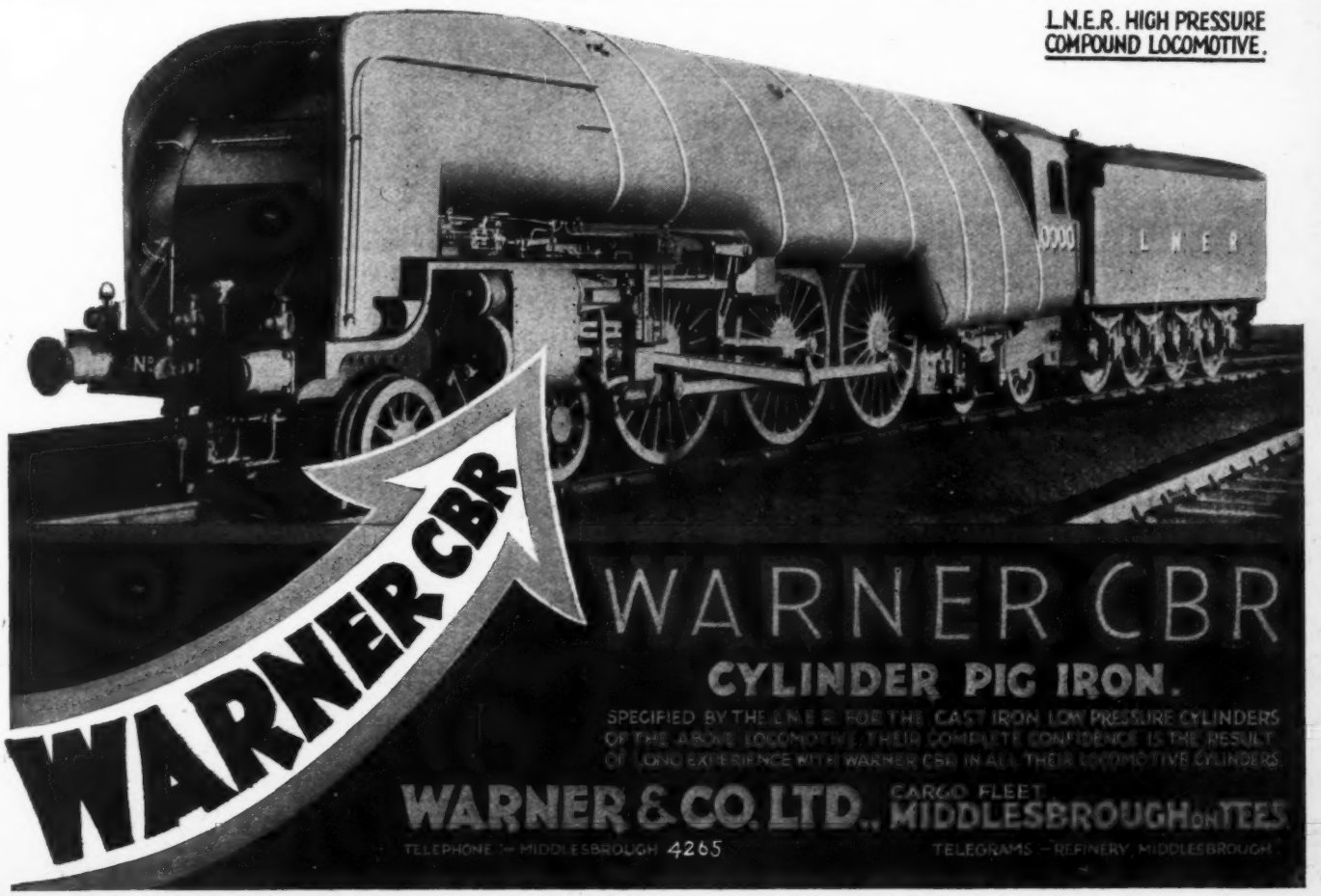

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COPPER.

	£	s.	d.
Standard cash	54	5	0
Three months	54	5	0
Electrolytic	64	0	0
Tough	59	10	0
Best selected	60	0	0
Sheets	92	0	0
India	77	0	0
Wire bars	65	15	0
Do. May	65	15	0
Do. June	65	15	0
Ingot bars	65	15	0
H.C. wire rods	68	0	0
Off. av. cash, March	69	5	10⅝
Do., 3 mths., March	67	13	2 13/16
Do., Sttlmnt., March	69	5	11½
Do., Electro, March	83	16	6½
Do., B.S., March	76	11	3
Do., wire bars, March	84	5	0
Aver. spot price, copper, Mar.	69	5	10⅝
Solid drawn tubes			13d.
Brazed tubes			13d.
Wire			9d.

BRASS.

Solid drawn tubes	11¼d.
Brazed tubes	13½d.
Rods, drawn	10⅞d.
Rods, extd. or rlld.	7d.
Sheets to 10 w.g.	9⅜d.
Wire	9⅜d.
Rolled metal	9¼d.
Yellow metal rods	7d.
Do. 4 × 4 Squares	7½d.
Do. 4 × 3 Sheets	8d.

TIN.

	£	s.	d.
Standard cash	160	12	6
Three months	162	17	6
English	161	15	0
Bars	165	5	0
Straits	164	5	0
Australian	163	7	6
Eastern	167	0	0
Banca	168	2	6
Off. av. cash, March	164	19	0⅛
Do., 3 mths, March	167	0	2⅞
Do., Sttlmt., March	164	19	2
Aver. spot, March	164	19	0⅞

SPELTER.

	£	s.	d.
Ordinary	17	6	3
Remelted	16	10	0
Hard	14	15	0
Electro 99.9	19	15	0
English	17	17	6
India	15	15	0
Zinc dust	25	0	0
Zinc ashes	5	0	0
Off. aver., March	18	11	1⅛
Aver., spot, March	18	6	0⅞

LEAD.

	£	s.	d.
Soft foreign ppt.	17	15	0
English	19	15	0
Off. average, March	18	17	5 9/16
Average spot, March	18	16	1⅞

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	28	0	0
Do. V.M. ex-whf.	26	10	0
Rods	30	0	0
Boiler plates	24	10	0
Battery plates	25	0	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	40	0	0
Chinese	29	10	0
Crude	20	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	15	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	7	15	0
45/50%	11	10	0
75%	19	0	0
Ferro-vanadium—			
35/50%	12/9 lb. Va.		
Ferro-molybdenum—			
70/75% c. free	4/2 lb. Mo.		
Ferro-titanium—			
23/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£16	0	0
Ferro-tungsten—			
80/85%	2/10 lb.		
Tungsten metal powder—			
98/99%	3/1 lb.		
Ferro-chrome—			
2/4% car.	£30	10	0
4/6% car.	£23	7	6
6/8% car.	£22	12	6
8/10% car.	£22	0	0
Ferro-chrome—			
Max. 2% car.	£33	10	0
Max. 1% car.	£37	17	6
Max. 0.70% car.	£39	15	0
70%, carbon-free	11d. lb.		
Nickel—99% cubes, or pellets	£175	0	0
Ferro-cobalt	9/6 lb.		
Aluminium 98/99%	£95	0	0
Metallic chromium—			
96/98%	2/7 lb.		
Ferro-manganese (net)—			
76/80% loose	£11	15	0
76/80% packed	£12	15	0
76/80%, export	£11	10	0
Metallic manganese—			
94/96%, carbonless	1/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	£	s.	d.
Finished bars, 14% tungsten	£0	2	2
Finished bars, 18% tungsten	£0	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/32 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	3	2	6	to	3	3	6
Bundled steel and shrngs.	2	17	6	to	3	0	0
Mixed iron and steel					2	17	6
Heavy cast iron	2	17	6	to	2	19	0
Good machinery for foundries					3	0	0
Cleveland—							
Heavy steel					3	0	0
Steel turnings					2	12	6
Cast-iron borings					2	8	0
Heavy forge					3	14	6
W.I. piling scrap					3	10	0
Cast-iron scrap	3	1	0	to	3	4	0
Midlands—							
Ord. cast-iron scrap					3	3	6
Heavy wrought					3	12	6
Steel turnings					1	17	6
Scotland—							
Heavy steel					3	2	6
Cast-iron borings					2	9	0
Wrought-iron piling					3	18	6
Heavy machinery					3	8	6
London—Merchants' buying prices delivered yard.							
Copper (clean)					65	0	0
Brass					42	0	0
Lead (less usual draft)					16	10	0
Tea lead					12	10	0
Zinc					11	0	0
New aluminium cuttings					64	0	0
Braziery copper					60	0	0
Gunmetal					54	0	0
Hollow pewter					120	0	0
Shaped black pewter					87	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	70/-
Foundry No. 3	67/6
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1	75/-
Hematite M/Nos.	74/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	85/6
„ d/d Birm.	94/6
Midlands—	
Staffs. common*	—
„ No. 4 forge*	74/6
„ No. 3 fdry.*	78/6
Shrops. basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	71/-
„ fdry. No. 3*	75/-
Derbyshire forge*	74/6
„ fdry. No. 3*	78/6
„ basic*	—
*d/d Black Country dist.	
Scotland—	
Foundry No. 1	80/6
„ No. 3	78/-
Hem. M/Nos.	81/-
Sheffield (d/d district)—	
Derby forge	68/6
„ fdry. No. 3	72/6
Lincs. forge.	71/-
„ fdry No. 3	75/-
E.C. hematite	89/-
W.C. hematite	90/-
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	73/-
„ fdry. No. 3	77/-
Staffs foundry No. 3	77/-
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	95/-
Glengarnock, No. 3	—
Gartsherrie, No. 3	95/-
Monkland, No. 3	95/-
Shotts, No. 3	95/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

	£	s.	d.		£	s.	d.
Iron—							
Bars (cr.)					10	15	0
Nut and bolt iron	9	0	0	to	9	7	6
Hoops					10	15	0
Marked bars (Staffs) f.o.t.					12	10	0
Gas strip					10	15	0
Bolts and nuts, ¾ in. × 4 in.					15	5	0
Steel—							
Ship plates	8	15	0	to	8	17	6
Boiler plts.	9	17	6	to	10	10	0
Chequer plts.					10	12	6
Angles					8	7	6
Tees					9	7	6
Joists					8	10	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¾ in. (Untested)					8	2	6
							and upwards
Flats—8 in. wide and over					8	12	6
„ under 8 in. and over 5 in.					8	17	6
Rails, heavy					8	10	0
Fishplates					12	0	0
Hoops (Staffs)	9	5	0	to	9	15	0
Black sheets, 24 g.					9	15	0
Galv.cor.shts., 24g.	11	17	6	to	12	0	0
Galv. fencing wire, 8g. plain					12	0	0
Billets, soft	6	0	0	to	6	10	0
Billets, hard	7	10	0	to	8	0	0
Sheet bars	5	15	0	to	6	5	0
Tin bars	5	15	0	to	6	5	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/2
Sheet to 10 w.g.	1/2½
Wire	1/3½
Rods	1/3
Tubes	1/7½
Castings	1/2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.00
Basic	20.26
Bessemer	20.76
Malleable	20.76
Grey forge	19.76
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	43.00
Billets	33.00
Sheet bars	33.00
Wire rods	38.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.85
Skelp, sheared steel	1.85
Steel hoops	2.20
Sheets, black, No. 24	2.55
Sheets, galv., No. 24	3.30
Sheets, blue an'l'd, No. 13	2.25
Wire nails	2.15
Plain wire	2.40
Barbed wire, galv.	2.95
Tinplates, 100-lb. box	$5.25

COKE (at ovens).

Welsh foundry	27/6 to 30/-
„ furnace	17/6 to 22/6
Durham and Northumberland—	
„ foundry	15/6
„ furnace	16/-
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box	18/4½
„	28×20 „	36/9
„	20×10 „	26/4½
„	18¾×14 „	19/1½
C.W.	20×14 „	16 6
„	28×20 „	33/9
„	20×10 „	23/6
„	18¾×14 „	17/-
Terneplates	28×20	32/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-Iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	17	6	to	£16	15	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods dead soft, steel	£11	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ¼ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

			£	s.	d.		
April	17	..	58	17	6	inc.	2/6
,,	18	..	—			—	
,,	21	..	—			—	
,,	22	..	55	7	6	dec.	70/–
,,	23	..	54	5	0	,,	22/6

Electrolytic Copper.

			£	s.	d.	
April	17	..	65	0	0	No change
,,	18	..	—			—
,,	21	..	—			—
,,	22	..	65	0	0	No change
,,	23	..	64	0	0	dec. 20/–

Standard Tin (cash).

			£	s.	d.		
April	17	..	165	0	0	inc.	12/6
,,	18	..	—			—	
,,	21	..	—			—	
,,	22	..	162	2	6	dec.	57/6
,,	23	..	160	12	6	,,	30/–

Tin (English ingots).

			£	s.	d.		
April	17	..	166	0	0	inc.	10/–
,,	18	..	—			—	
,,	21	..	—			—	
,,	22	..	163	5	0	dec.	55/–
,,	23	..	161	15	0	,,	30/–

Zinc Sheets (English).

			£	s.	d.	
April	17	..	28	0	0	No change
,,	18	..	—			—
,,	21	..	—			—
,,	22	..	28	0	0	No change
,,	23	..	28	0	0	,, ,,

Spelter (ordinary).

			£	s.	d.	
April	17	..	17	16	3	dec. 2/6
,,	18	..	—			—
,,	21	..	—			—
,,	22	..	17	10	0	dec. 6/3
,,	23	..	17	6	3	,, 3/9

Lead (English).

			£	s.	d.	
April	17	..	12	15	0	dec. 5/–
,,	18	..	—			—
,,	21	..	—			—
,,	22	..	19	10	0	dec. 5/–
,,	23	..	19	15	0	inc. 5/–

AVERAGE MONTHLY PRICES OF STEEL SHIP PLATES (NORTH OF ENGLAND).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	5 0 0	5 0 0	5 2 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 2 6	5 10 0	5 10 0	5 2 6
1897	5 10 0	5 10 0	5 10 0	5 7 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 7 6	5 10 0	5 5 5
1898	5 10 0	5 8 9	5 10 0	5 10 0	5 16 3	5 18 9	5 17 6	6 0 0	6 2 6	6 5 0	6 10 0	6 15 0	5 18 6½
1899	6 15 0	7 0 0	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 12 6	7 12 6	7 12 6	7 12 6	8 0 0	7 6 5½
1900	8 0 0	8 0 0	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 0 0	8 0 0	8 0 0	7 10 0	7 0 0	8 0 0
1901	6 15 0	6 15 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 5 0	6 7 6	6 5 0	6 0 0	6 0 0	6 4 4
1902	5 17 6	5 12 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 14 7½
1903	5 10 0	5 10 0	5 15 0	6 0 0	6 0 0	6 0 0	5 12 0	5 12 6	5 12 6	5 12 6	5 12 6	5 10 0	5 13 11
1904	5 7 6	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 11 10
1905	5 15 0	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	6 0 0	6 10 0	7 0 0	7 0 0	6 2 3½
1906	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 10 0	7 0 10½
1907	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 8 4
1908	6 10 0	6 10 0	6 10 0	6 5 0	6 5 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 3 9
1909	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 0 0	6 0 0	5 18 9
1910	6 5 0	6 5 0	6 7 6	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 2
1911	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 18 4	6 15 3½
1912	7 3 9	7 5 0	7 5 0	7 12 6	7 15 0	7 15 0	7 15 0	8 0 0	8 0 0	8 0 0	8 2 0	8 5 0	7 14 10
1913	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	7 19 0	7 15 0	7 3 0	6 15 0	6 10 0	7 16 5½
1914	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 0 0	6 0 0	7 0 0	7 5 0	7 5 0	7 6 3	7 10 0	6 14 8½
1915	8 0 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 5 0	11 0 0	9 12 11
1916	11 7 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 9 2
1917	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1918	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1919	11 10 0	14 0 0	14 0 0	14 0 0	17 0 0	17 7 6	17 15 0	18 5 0	18 5 0	18 5 0	19 12 6	21 5 0	16 15 5
1920	22 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	24 0 0	24 10 0	24 5 0	24 5 0	23 13 4
1921	23 5 0	22 10 0	20 4 0	19 0 0	19 0 0	17 0 0	15 0 0	14 15 0	13 12 0	12 5 0	10 10 0	10 10 0	16 9 3
1922	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 0	10 0 0	9 7 6	9 4 0	9 5 0	9 5 0	9 5 0	9 18 4½
1923	9 7 6	9 15 0	10 5 0	10 10 0	10 10 0	10 10 0	9 18 9	9 17 6	9 17 6	9 17 6	9 18 6	10 6 10½	10 1 2½
1924	10 1 6	9 18 1½	9 17 6	9 17 6	9 17 6	9 19 4½	10 5 0	10 5 0	10 5 0	9 19 0	9 15 0	9 15 0	9 19 7½
1925	9 14 0	9 10 0	9 10 0	9 1 3	9 0 0	9 0 0	8 17 0	8 13 1½	8 7 6	8 5 6	7 16 3	7 14 3	8 15 8½
1926	7 12 2½	7 12 6	7 12 6	7 14 4½	7 15 0	7 16 10½	8 2 6	8 2 6	8 4 0	8 12 6	8 12 6	8 16 3	8 1 1½
1927	8 17 6	8 17 6	8 11 6	8 7 6	8 6 3	8 5 0	8 5 0	8 3 9	8 2 6	8 2 6	8 5 0	8 5 0	8 7 5
1928	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 6 10½
1929	8 7 6	8 7 6	8 7 6	8 7 6	8 10 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 13 9	8 10 9½
1930	8 15 0	8 15 0	8 15 0	—	—	—	—	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

PIG IRON

REGISTERED TRADE MARK

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

ESTIMATING Draughtsman required by large Aluminium Foundry in N.W. London. Applicants must have had experience of foundry weight estimation and general procedure, and must be quick and accurate.—Reply, giving age, particulars of experience, and salary required, to Box 488, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

WANTED, Traveller, experienced, calling ironfounders, charcoal users, wood by-products and other chemicals, West Riding Yorkshire and East Lancashire districts.—Box 490, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PROPERTY.

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of SHOPPING,

Compact and Convenient.

SIDING CONNECTIONS

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WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

FACTORY Premises, with plot of Land, House, for Sale, with vacant possession; suitable for almost any trade; owner leaving district.—Apply, Wellings & O'Mara, Earlsfield, S.W.18.

PUBLICATION.

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. 1930 edition. Price 42s., bound in cloth.—Industrial Newspapers, Ltd., 49, Wellington Street, Strand, London, W.C.2.

PATENTS AND TRADE MARKS.

PROTECT YOUR IDEAS.—Free, Advice and Handbook on patenting inventions and registering trade marks by Registered Agent with 43 years' experience.—King's Patent Agency, Limited, 146A, Queen Victoria Street, E.C.4.

SALE BY TENDER.

THE GLASLYN FOUNDRY & ENGINEERING COMPANY, LIMITED, PORTMADOC.

TENDERS are invited for the purchase of the above old-established Foundry and Engineering Works, together with the Plant, Patterns, Machinery, including Modern Electric and Oxy-Acetylene (High-Pressure) Welding Equipment.

The highest or any Tender will not necessarily be accepted.

All particulars to be had from the Liquidator, and all Tenders to be sent to him on or before May 1, 1930, duly sealed and marked "The Glaslyn Foundry," and addressed The Liquidator, Glaslyn Foundry & Engineering Company, Limited, c/o Messrs. Lloyd George & George, Solicitors, 103, High Street, Portmadoc.

BUSINESS FOR SALE.

BIRMINGHAM.—Old-established Engineer's, Ironfounder's and Patternmaker's Business. Modern premises. Central position.—Stevens, Champion & Slater, 71, Temple Row, Birmingham.

MACHINERY.

SAND MIXERS.—New and Secondhand Ask us to quote.—W. Brealey & Company, Limited, Prospect Works, Hawksley Avenue, Sheffield.

ONE "Thwaites" Rapid Cupola, as new, size 4, capacity 3 to 4 tons per hour, casing 3 ft. 6 in. dia., overall height 24 ft. 8 in., drop bottom with receiver at side. Price, with one set of bricks (new), £85.—Mobbs & Company, Limited (In Voluntary Liquidation), Lion Foundry, Northampton.

BLOWER, one High-Pressure, by Samuelson, capacity 12,000 cub. ft. of air per min. at 30 in. pressure, guaranteed in condition equal to new, little used, cheap for immediate sale.—Constructional Engineering Company, Limited, Titan Works, Birmingham.

THOS. W. WARD, LTD.

RICHARDS 5-ft. Vertical Boring and Turning Mill, with 56 in. dia. table.

No. 60 HEALD Internal Grinder, with planetary head.

4-ft. ARCHDALE Radial Drilling and Tapping Machine, all geared, s.p.d.

34 in. Swing DEFRIES Vertical Boring and Turning Mill, with 30-in. chuck.

STONE BREAKERS, 12 in. x 6 in. to 30 in. x 18 in. size; all good order.

"SMART & BROWN" PETROL-DRIVEN WINCH, capable of lifting 1 ton at 100 ft. per min.; 12-b.h.p. Engine.

One New 10-n.h.p. PORTABLE STEAM ENGINE AND BOILER.

FOUNDRY LADLES, various types and sizes.

20,000 ft. 1-in. New Black Steel Screwed and Socketed Piping in lengths of 18 ft. and upwards. Tested to 210 lbs. hydraulic pressure.

(ASK FOR "ALBION" MACHINERY CATALOGUE.)

ALBION WORKS, SHEFFIELD.

MISCELLANEOUS.

SEA SAND wanted; regular weekly supplies; not less than 50 tons; must be clean; quote f.o.r.—Box 492, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PATTERNS IN WOOD AND METAL for all branches of Engineering. Moulding methods carefully considered.—Furniston & Lawlor, Letchworth.

FLUORSPAR. — The Ideal Flux for all Foundry and Furnace work; supplied in crude lump, washed gravel or finely ground. Samples and prices from

A. BECK,
MINEOWNER, MATLOCK.

NON-FERROUS CASTINGS. — Inquiries solicited from the Trade. Prompt attention; first-class products; reasonable prices.—Precision Castings, Limited, Lincoln Street, Wolverhampton.

"PURIC" CUPOLA FLUX in Block Form cleanses and desulphurises all cupola mixtures. No increase in cost of mixtures, but actual saving obtained, owing to the production of better metal and owing to less wear on the furnace linings.

Over 600 foundries have testified to the advantage of using "Puric." Send for trial cwt.—Write, Beecroft & Partners, Limited, The Foundry Chemists, Retort Works, Mappin Street, Sheffield.

Foundry Consultants and Advisors. Analyses and Testing carried out at low rates at The Laboratories, St. Peter's Close, Sheffield.

MISCELLANEOUS—*Continued.*

GANISTER, best quality for cupolas, also for Steel Works.—Astbury Silica Company, "The Brooms," Park Lane, Congleton.

'Phone: 287 SLOUGH

MOULDING MACHINES

Two Britannia head ram machines	£24 each
Two No. 1 Britannia jar ram machines	£38 each
One 48" × 24" Darling & Sellars turnover	£28 (new)
One 24" × 20" Jackman hand turnover	£18

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